U. S. DEPARTMENT OF LABOR
BUREAU OF LABOR STATISTICS
ROYAL MEEKER, Commissioner

BULLETIN OF THE UNITED STATES BUREAU OF LABOR STATISTICS . . . WHOLE NUMBER 209

INDUSTRIAL ACCIDENTS AND HYGIENE SERIES: NO. 12

HYGIENE OF THE PRINTING TRADES

ALICE HAMILTON, M. A., M. D.
and
CHARLES H. VERRILL

APRIL, 1917

WASHINGTON
GOVERNMENT PRINTING OFFICE
1917

PUBLICATIONS OF THE BUREAU OF LABOR STATISTICS.

[The publication of the annual and special reports and of the bimonthly bulletin has been discontinued, and since July, 1912, a bulletin has been published at irregular intervals. Each number contains matter devoted to one of a series of general subjects. These bulletins are numbered consecutively in each series and also carry a consecutive whole number, beginning with No. 101. A complete list of the reports and bulletins of the Bureau will be furnished on application.]

A list of the series of bulletins now published by the Bureau is as follows:

Wholesale Prices.
Retail Prices and Cost of Living.
Wages and Hours of Labor.
Employment and Unemployment.
Women in Industry.
Workmen's Insurance and Compensation (including laws relating thereto).
Industrial Accidents and Hygiene.
Conciliation and Arbitration (including strikes and lockouts).
Labor Laws of the United States (including decisions of courts relating to labor).
Foreign Labor Laws.
Vocational Education.
Miscellaneous Series.

INDUSTRIAL ACCIDENTS AND HYGIENE.

Prior to the publication of the bulletins of the Bureau in the present form, many reports were issued devoted wholly or in part to the subject of "Industrial Accidents and Hygiene." For a full list of these the reader is referred to Bulletin 174, Subject Index of the Publications of the Bureau of Labor Statistics, up to May 1, 1915. Reports dealing with the subject are as follows:

*Bul. 40, May, 1902, Report of French bureau of labor regarding industrial hygiene.
*Bul. 44, January, 1903, Factory sanitation and labor protection.
*Bul. 67, November, 1906, Austria, lead and zinc works, 1904.
*Bul. 72, September, 1907, Health of Cornish miners, 1902.
*Bul. 75, March, 1908, Industrial hygiene.
*Bul. 77, July, 1908, Compensation for industrial diseases, Great Britain, 1906.
*Bul. 79, November, 1908, Mortality from consumption in dusty trades.
*Bul. 80, January, 1909, Compensation for industrial diseases, Great Britain, 1908.
*Bul. 82, May, 1909, Mortality from consumption in occupations exposing to municipal and general organic dust.
*Twenty-fourth Annual Report, 1909, Workmen's insurance and compensation systems in Europe.
*Bul. 86, January, 1910, Phosphorus poisoning in the match industry in the United States.
List of industrial poisons.
Bul. 89, July, 1910, Child-labor legislation in Europe.
*Bul. 92, January 11, 1911, Resolutions of the sixth delegates' meeting of the International Association for Labor Legislation: Industrial poisons.
Report of Illinois Commission on Occupational Diseases.
*Bul. 95, July, 1911 Industrial lead poisoning in Great Britain and western Europe.
The white-lead industry in the United States, with an appendix on the lead-oxide industry.
Deaths from industrial lead poisoning in New York State in 1909 and 1910.
Laws enacted during 1911 requiring the report of occupational diseases.
*Bul. 96, September, 1911, Attitude of Massachusetts employers toward the health of their employees.
1911, Conditions of employment in the iron and steel industry in the United States (S. Doc. 110, 62d Cong., 1st sess.), Vol. III.

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* Supply exhausted.

[See also third page of cover.

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WHOLE NO. 209. WASHINGTON. APRIL, 1917.

HYGIENE OF THE PRINTING TRADES.

BY ALICE HAMILTON, M. A., M. D., AND CHARLES H. VERRILL.

INTRODUCTION.

This study was made primarily to discover what influence, if any, the presence of lead and of other less important toxic substances has upon the men engaged in the printing trade, and incidentally to observe all the features of the industry which might have an indirect bearing on health. In order to do this it has been necessary to examine actual conditions in the printing trade in typical American cities and to make a study of the actual physical condition of the present generation of printers. Seven cities[1] were selected which were regarded as having typical industrial conditions and a personal inspection was made of 130 plants in which all the processes used in printing, including type founding, were studied. As there are in this country no complete statistics of sickness and deaths among printers available it was decided to make an investigation of the physical condition of groups of employed printers, taking so far as possible a typical cross section of the industry, in order to determine the effect of their occupation upon their health. One hundred printers in Chicago and 100 in Boston consented to submit to a thorough physical examination by physicians who had had special experience in detecting occupational disease. In addition to these examinations all possible information concerning causes of death among printers was collected from the records of the International Typographical Union.

The special dangers to be considered in the printing trades, especially in hand composition, linotype and monotype casting, stereotyping, and electrotyping, are the exposure to lead and antimony

[1] These cities are Boston, New York, Philadelphia, Baltimore, Washington, Chicago, and St. Louis.

dust and to possible fumes from molten lead; to various volatile poisons used in cleaning press rollers and old type; to irritating and toxic fumes from remelting ink-covered type metal, and to poisonous fumes from the gas burners under the various type-casting machines.

The description which follows is based on visits to 130 establishments—in Boston (including Cambridge), New York (including Garden City, L. I.), Philadelphia, Baltimore, Washington, Chicago, and St. Louis. Thirty-four of these were newspaper offices, 84 were book and job publishing houses, and 12 did electrotyping only. Of the book and job printing offices, 56 were large, employing more than 12 workpeople in the departments under investigation, and 26 were small, employing less than 12. In 4 there were type foundry departments. The departments studied were the composing room, including linotype operating and monotype casting, the stereotype foundry, the electrotype foundry, the pressroom, and the department in which used type is remelted and cast and, in some cases, lead dross refined. Other departments, such as the bindery or those of the various processes of photo-engraving and lithography, were not included.

The points noted were: First, the construction of the building, including the height of the ceilings, the character of ventilation, natural and artificial, including special apparatus for carrying off fumes, the character of flooring and of furniture, the character of lighting, natural and artificial, and the provision of washing facilities, of lunch rooms, of toilet rooms, and of drinking water. Second, the upkeep, the actual condition as regards cleanliness, temperature, purity of air, and dust prevention; the method of cleaning floors and the time of day selected for this cleaning; the method of cleaning the dust out of type cases and of cleaning ink off old type and press rollers; the method of disposing of lead scrap; the care of linotype machines, and the actual working of devices installed to prevent dust and fumes. Other features noted were the separation of possibly dangerous processes from safe work, the character of work intrusted to boys and to women, and the sanitary reforms instituted by the printers themselves during recent years.

SUMMARY.

In all countries the printer's trade has been considered an occupation unhealthful beyond the average, and this belief is borne out by statistics, which show an abnormally high sickness rate and death rate for printers as compared with all occupied males.

Examination of all available sources of information in the United States shows that in this country the printer's trade is productive of more illness than would be expected in an industry where wages are high, hours usually not long, and where there is no gross contamina-

tion of the air nor exposure to excessive heat or cold, nor overexertion. American printers suffer far more from tuberculosis than do occupied males in general.

Statistics compiled from the records of the International Typographical Union covering almost 12,000 deaths between 1893 and 1915, show a decided lowering of the death rate from tuberculosis and an increase in the expectation of life. This improvement is greater than that among men in the general population during these years.[1] It is probably to be attributed to improvements in shop hygiene, less exposure to lead owing to the use of machines, the educational work of the International Typographical Union in regard to tuberculosis, the prompt care of tuberculous printers since the establishment of the Printers' Home in Colorado, and the shorter workday. It is probable that the gradual rise in the standard of living among printers has also tended to lower the death rate from tuberculosis.

The unhealthful features of the industry are the following: It is an indoor occupation, often carried on in vitiated air; it requires little physical exertion, and in consequence the printer's circulation is apt to be sluggish and he is oversensitive to cold; the nervous strain is great; the printer is exposed to the effect of various poisonous substances, the most important of which is lead.

The importance of lead in the production of disease among printers is emphasized especially by the Austrian, Dutch, and Italian authorities, while the Germans are more divided on the subject, and the British believe that the danger from lead is not great.

Lead poisoning may be acquired by handling food or tobacco with hands which have become smeared with lead. It may also be acquired by breathing lead dust and fumes.

The sources of lead dust are: In the composing room, the dust from type cases; in the linotype room, the scraps of lead from the machine which fall on the floor and are ground up by the feet of passers-by and the dust from cleaning machine and plunger; in stereotyping and electrotyping, the scraps from trimmers and routers and saws, and the dross from the kettles. In addition most shops melt and recast used type and scrap, and this is another source of lead dust.

Analyses of dusts collected from various surfaces in Washington printing plants showed the presence of lead, small in amount, but important because even very small quantities of lead in the air breathed for many years may cause chronic lead poisoning.

Lead poisoning may also be acquired by exposure to the fumes arising from molten lead. Analyses of the air surrounding molten lead

[1] See page 77.

at the temperatures usual in the various processes of printing show that the heat used is not great enough to cause lead to be given off from these pots so long as the molten metal is at rest, but when it is agitated by stirring, or by skimming off dross, or by ladling and pouring, there is a contamination of the air by the discharge of the fine, light coating of oxide which always forms on the surface of molten lead.

In stereotyping, electrotyping, and remelting and casting type, the agitation of the metal is enough to cause lead contamination of the surrounding air.

In linotype and monotype casting the molten metal is little disturbed and there is no evidence of air contamination from this source. It is highly probable that the symptoms of ill health complained of by linotypists and monotype casters are in reality due to the contamination of the air by carbon monoxide from the naked burners under the melting pots. There should always be exhaust-ventilation over such burners, or electric heating should be substituted for gas heating.

A slowly developing form of lead poisoning may occur in linotypists as a result of the dust incident to the work as it is usually carried on.

Lead poisoning, when it occurs in printers, is of a slow, chronic, insidious form, not easily recognized because not typical. The chief injury done by lead is probably to be found, not in the production of true plumbism, but in a lowering of the resistance to other diseases, especially to certain infections. In this way is explained the high death rate from tuberculosis. Lead poisoning and tuberculosis go hand in hand in this trade, both being highest in the occupations with greatest exposure to lead and both falling as cleanliness and good ventilation increase.

Chronic lead poisoning causes a general hardening of the blood vessels and as a result of this, certain organs, liver and kidneys especially, are starved for blood and degenerate. As another result of this same change in the blood vessels there may be heart disease, for the heart is both poorly nourished and forced to greater effort to drive the blood through the rigid vessels. If there is a sudden rise in the blood pressure in the brain, one of the brittle vessels may break and an attack of apoplexy result, with paralysis. Bright's disease, apoplexy and paralysis are all remote effects of chronic lead poisoning.

Foreign experts say that lead poisoning is unimportant as a cause of death among printers, but important as a cause of sickness. The same thing seems to be true of American printers. An examination of 200 working printers in Boston and Chicago showed that 18, or

9 per cent, were suffering from chronic lead poisoning. Only 93 men, or 46.5 per cent, were free from noteworthy symptoms of ill health; the remaining 107 had health more or less impaired.

Foreign experts attribute the ill health of printers in large part to the fact that this industry is recruited from the weaker, less well developed boys, who enter the trade believing it to be easy. While this seems to be far less true of the trade in this country, the statistics of the Prudential Insurance Co. show that printers average slightly lower in stature and weight than occupied males in general.

In addition to lead, printers are exposed more or less to certain other poisons: Antimony in type metal; carbon monoxide from gas burners; volatile petroleum products or coal tar products used to clean type and press rollers; turpentine used for the same purpose; anilin oil and possibly wood alcohol and tetrachloride of carbon, used as roller cleaners; lye water, for washing type and forms; acrolein fumes, which develop when old ink-covered type is heated for remelting.

A study of conditions in 130 printing plants (including type founding and electrotyping) in seven American cities showed that disease-producing conditions are to be found in many shops, although in general there has been a marked improvement in sanitation during recent years and several model establishments are to be seen in these cities.

Ventilation is often inadequate, for where ordinary window ventilation is depended on the men usually refuse to permit the windows to be opened except in warm weather.

Type cases with lead dust are commonly blown clean with a bellows, and this endangers the man who does it and sometimes others in the composing room. Dry sweeping of lead fragments and dust and dry dusting and cleaning of type-casting machines are usual.

Processes involving exposure to lead dust and fumes are often carried on in the same room with processes quite free from such danger, thus unnecessarily exposing many workmen.

Boys are required to do work exposing them to lead dust, to the effects of which they are more susceptible than are adults.

Washing facilities are in the majority of printing shops very inadequate, and men who bring their lunch to the shop often eat with hands only partly cleaned.

Naked gas burners are used for type-casting machines and melting pots, and the gas is allowed to contaminate the air in many shops.

Prevention of occupational disease among printers requires the following measures: Ample ventilation in all sorts of weather; electric heating of lead pots or exhaust ventilation to carry off gas fumes; scrupulous cleanliness of the premises; no dry sweeping or

dry dusting or blowing out of type cases, or dry cleaning of casting machines and plungers; proper lighting; separation of processes which produce lead dust or fumes from other processes; prevention of excessive heat, especially moist heat; ample washing facilities; no excessive speeding up or excessively long hours; prohibition of boys' work in processes involving exposure to lead dust or fumes.

DESCRIPTION OF PRINTING PLANTS.

There has been a very great improvement of late years in the construction of printing establishments, as can be seen when some of the old buildings in Boston or Philadelphia or even Chicago are compared with those constructed within the past 10 or 15 years. Formerly it was taken for granted that printing should be for the most part carried on in small, low, dark, crowded rooms, with dust-incrusted floors, dim windows never opened, and furniture covered with the accumulated dust of years. Now such a place is the exception, and in every one of the seven cities which were visited in the course of this inquiry more than one model establishment was found, large and clean and even beautiful. To be sure there remains still much room for improvement in the average printing plant, and the very best establishments sometimes reveal a surprising piece of oversight or of neglect, so that employees who are enjoying the luxury of lunch rooms and of bubbling fountains with iced water may at the same time be running the risk of lead poisoning from quite preventable dust or fumes. The sanitation of this industry has not proceeded along logical lines, doing away with the dangers in the order of their importance and providing first for safety, second for comfort and beauty; rather it has proceeded capriciously, and the desirable has sometimes been given more attention than the really essential. Attractively painted walls in the composing room are pleasant, but hot water to enable the compositor to get the lead off his hands before he eats his lunch is decidedly more important. It is a matter of surprise to find in an apparently model establishment, one which is an evident source of pride to the proprietors, such a really insanitary feature as the placing of the melting pot for old metal in the composing room.

The floor in American printing shops is almost always either of wood or of cement or concrete. The latter is supposed to be more modern, more durable, and cleaner, but the men themselves are usually not at all enthusiastic over cement floors. To the assertion that cement is clean they reply that many of these floors give off a fine powder which is more objectionable than the dust from a wooden floor. They object also to the coldness and dampness of cement floors. They say that they are more slippery and men are more likely to have accidents from losing their footing, but the most frequent complaint of all is that flat foot is likely to result from long standing on this

rigid, unyielding surface. To obviate this all sorts of devices are used. Some men stand on mats composed of several layers of old carpet, others use wooden boxes or strips of cork, and the employer sometimes provides low wooden platforms, especially for the compositors. There are, however, printing plants with cement floors in which there is no complaint at all from the employees; on the contrary, they say they prefer them to wooden floors.

Usually hand compositors in job shops stand at their cases, while those in newspaper work often sit. There seems no reason why all could not sit. The cases are not adjusted to the different statures of the men and stools would be much easier for men who are above or below the average height. Their use would also help to prevent flat foot.

VENTILATION.

Most printing plants, the great majority in fact, depend on window ventilation entirely. Where this is carefully planned, it may give fairly good ventilation, as when the top part of the window is made to open in such a way as to deflect the air upward first, against the ceiling, or when the lower sash is raised with a shield in front of it and the air passes up between the two sashes. Even then the men working nearest to the window may object to the cold, and when the only way to admit fresh air is by throwing open a window, it may be taken for granted that no fresh air will be admitted except in summer. Work in the composing room involves very little muscular effort; it is largely standing or sitting in one place and making movements which require the use of only the smaller muscles, and consequently the circulation of blood is sluggish and the compositor is oversensitive to chilling of the surface of the body. No matter how much the men at a distance from the windows may clamor for better ventilation the men near the windows will insist on keeping them shut, except on the warmest days. In the pressroom, drafts must be avoided for the sake of the ink, but on the whole the air in pressrooms is usually better than in composing rooms, perhaps because there are more cubic feet of air space per man, perhaps because the movement of the machinery, especially where there are belts, tends to keep the air stirring.

Of late years the whole conception of what constitutes bad air has had to be revised, largely as a result of the researches of Haldane and Hill in England, Flügge in Germany, and Benedict, F. S. Lee and C.-E. A. Winslow in this country. We know now that bad air is not necessarily air which has a lowered percentage of oxygen or an increased percentage of carbon dioxide or is contaminated with so-called animal emanations. Bad air is stagnant, hot, and humid air. The feeling of discomfort, of flushed face, of dulled mentality, and of

headache, which is experienced in a close room may be dispelled by simply stirring up the air even if no fresh air be admitted, for when air stagnates, when there are no air currents, that which is in contact with the body becomes overcharged with both heat and humidity from the body itself, which is, as it were, inclosed in a blanket of moist, hot air. This condition can be remedied only by making the air move so that fresh, unsaturated portions take the place of the saturated. Men in the pressroom moving about in air stirred up by the movement of the presses suffer far less from bad air than do linotypists sitting for hours at their machines or compositors standing at their cases. Considering how large a proportion of printing plants in this country are provided with electric lighting it is rather surprising that the very simple device of electric fans for improving the ventilation is not oftener used.

If window ventilation must be depended on, the best way to ventilate, according to these newer ideas of what constitutes good and bad air, is to flush the whole room thoroughly now and then, by opening windows and thus bringing about a complete stirring up and change of air. It is not possible to do this while the men are at work, but it can always be done either the last thing at night or the first thing in the morning, or better at both times, and then in the middle of the day, during the pause for lunch. This last procedure is required by the regulations governing the industry in several European countries—in Germany, in Switzerland, in Norway, and in France. The compositors might object that it would make the room too cold for them to stay and eat their lunch, but lunching should not be permitted in workrooms.

Artificial ventilation has been installed in some of the newer plants. A very excellent system was seen in a large Chicago printing office, which had been worked out by the foreman of the composing room. Even an old, poorly constructed plant may have a very good system of artificial ventilation which really renders it more hygienic than many newer plants. For instance there is in New York a newspaper plant, built down in a crowded part of the city, with very inadequate window space, but with such good artificial ventilation in composing room, stereotype foundry, and pressroom that it compares favorably, as far as good air is concerned, with the finest buildings in the country. The same is true of an old newspaper plant in Chicago.

Since humidity is one of the factors in bad air it is a very poor plan to have hot, humid work carried on where many men are employed. Many a composing room, otherwise good, is spoiled by having the steam tables for stereotype matrices placed there, unnecessarily, of course, for the work is not done by compositors and there is no reason why the tables should not be in a room apart where only

the men engaged in that work need suffer from the discomfort of the steam.

The experiments made by experts in ventilation tend to show that stagnant air, especially when it is too warm and overcharged with moisture, lessens a man's capacity for work, both physical and intellectual. Especially is the inclination to work diminished in such an atmosphere. Alertness and interest are replaced by dullness and listlessness, and the effort which must be made to overcome this feeling is quite disproportionate to the amount of work accomplished. Hot, moist, motionless air in a printing shop must result in a lowering of the efficiency of the men.

SEPARATION OF DIFFERENT PROCESSES.

Closely connected with the ventilation problem is the proper separation of certain processes involving the danger of lead poisoning from other comparatively safe processes. It is a great mistake to place melting pots and stereotype kettles in the composing room, for this introduces not only a source of heat but of air contamination from lead dust and possibly lead oxide, and there is no reason for it but economy of space. This is a very common fault in printing shops, even in some that are good in all other respects. There is a job shop in Boston which has in one corner of the composing room the worst possible accumulation of lead scrap and sweepings and in another corner a pot for melting old linotype metal, with dross skimmings scattered all over the floor around it. This is a rather poorly built place and open to criticism in many ways, but in a Philadelphia job shop which is quite good in other respects the composing room is spoiled by having not only the pot for linotype metal but the stereotype kettle right in the center of the room, away from the windows. Both kettles have hoods, but that over the stereotype kettle must be lifted while work is going on. The floor near these kettles was covered with great heaps of old type and trimmings and lead scrap of all kinds.

A Baltimore newspaper composing room also has the steam tables and the monotype casting machine, with its lead scrap and possible lead oxide to contaminate the air.

These are only a few instances which might be multiplied many times. In newspaper publishing houses it is the exception to find the composing room free from steam from the matrix tables or from lead dust from accumulations of scrap. In large book and job houses the processes are more likely to be kept separate and besides there is no stereotyping done in most of their work, but some of the smaller plants are very bad offenders in this respect. As contrasts, one might mention a St. Louis newspaper, one in Chicago, and one in Boston, all of which have all their remelting and casting of "biscuits" for the linotypes done in special rooms, shut off from the

rest of the building. This is true also of a very large magazine publishing house in Philadelphia, and a small job house in the same city, of two large book and job shops in Boston, and of one in Chicago.

The placing of linotype machines in the composing rooms is a detriment to the men doing handwork. There is no proof that lead fumes are given off from the linotype metal pots, rather the contrary, but there is a contamination of the air with particles of lead dust from the scraps thrown out by the machines, and there is a further serious contamination with gases produced by the gas flames under these pots. (See pp. 33, 34, 40.)

Another unnecessary source of contamination of air in many printing shops is the irritating smoke which rises from the pots for remelting used type soon after the fire is started. This smoke comes from the ink on the used type, and contains a product of the decomposition of the oily constituents of the ink, acrolein, an irritating poison. (See pp. 32, 33.)

Loud noises, especially when accompanied by jarring, increase the fatigue from work of any kind. Compositors whose work is done in close proximity to a pressroom or a monotype casting machine will suffer from fatigue sooner than they would if they were working in a quiet place.

LIGHTING.

Insufficient light results in great eyestrain, especially to the far-sighted man, who is obliged to bring his work closer to his eyes than their natural powers of accommodation require, and this causes muscular fatigue. Only a few places, however, were found in this investigation where the light was deficient. This is the criticism often made of the printer's trade, that it causes frequent eye trouble because of poor lighting. As a matter of fact the opposite extreme is much more likely to be found nowadays, glaring, naked lights, so placed as to shine into the man's eyes, or if shades are provided, making small areas of brilliant illumination surrounded by the semidarkness of the rest of the room. This condition causes eyestrain, because each time a man looks up from the lighted to the darkened area his pupil must respond to the change by dilating, and then when he turns back to the brilliant light there is an instant of intense irritation to the retina before the reflex contraction of the pupil can take place. A room lighted in such a way as to afford great contrasts of light and dark is a badly lighted room. This fact is coming to be recognized, and in the better establishments an effort is made to provide well-diffused lighting in addition to the individual lights. These last should be adjustable to suit the varying heights of the men, and it is needless to say that clear electric-light globes should not be used unless they are carefully shaded.

There is a great deal of disagreement as to the mercury light. It is seen chiefly in newspaper plants, and the men who have installed it are usually enthusiastic in its praise, but there are establishments where it has been tried and given up because the men thought it was a strain to the eyes. The very best kind of artificial light involves of course some strain to the eye, and unfortunately there are few printing plants, especially among those situated in big cities, where the natural lighting is at all adequate. Some of the largest of the newer printing plants are, however, built in the more sparsely settled parts of the city and there the lighting may be excellent.

Overbright light is not only bad for the eyes, it is irritating to the nervous system. The sense of relief and soothing experienced when one steps from a sunny street into a darkened church has a true physiological basis, and since the work of composition is, at the best, nerve straining, it is a fact of some importance that overlighting is so very common in our printing plants. While only 7 of the 130 plants studied in this investigation were found to have insufficient lighting, no less than 45 were noted as having glaring lights, and doubtless this number would have been increased if all the plants had been visited on dark days when the artificial lights were in use.

WASHING FACILITIES, DRINKING WATER, AND LUNCH ROOMS.

Considering the high class of labor employed in this trade, which requires a very fair degree of education, especially among hand compositors, linotypists, and make-up men, the provisions for cleanliness and the toilet rooms in the majority of printing plants are surprisingly inadequate, sometimes really wretchedly neglected and dirty. Even when the plant is modern and in other respects very well equipped there is often only cold water for washing and neither soap nor towels provided, or if towels are provided, they are the insanitary roller towels which are forbidden by law in several of these cities.

The men can be required to provide their own towels and soap, but no one who has been handling metallic lead can thoroughly clean his hands without warm water. This is a point on which the health committees of the union might well be much more insistent than they have been so far. In this investigation the following conditions were found:

Establishments providing—	Number.
Hot water, soap, and individual towels	20
Hot water, soap, and roller towels	11
Hot water only	12
Cold water, soap, and individual towels	9
Cold water, soap, and roller towels	25
Cold water, and sometimes paper towels or roller towels, but usually neither, and no soap	53

The larger establishments, especially in the Middle West, often have cold drinking water piped to bubbling fountains, and a few, in which coolers of water are provided, furnish individual paper drinking cups, but the usual printing shop has only a cooler with a common cup or water from the tap with a common cup.

Lunch rooms are not needed in a great many printing shops which are situated in downtown districts, for the men usually prefer to go out for their lunch if there is a restaurant near. Still there is more lunching in rooms containing lead dust by men who have had only cold water to wash with than should be allowed.

Perhaps the most striking instance of recklessness in this respect was seen in the largest book and job house in Washington, which was visited during the lunch hour. This plant has a very extensive metal mixing and remelting department, in which seven to nine men are employed. The room is full of piles of old type metal, of scraps and shavings and trimmings, and of dross. The men went out to buy their lunch and returned bringing sandwiches and pie, which they proceeded to lay on the edge of one of the great melting pots in order to heat them. There is no European country in which any factory laws have been passed where such a dangerous thing as this would be allowed. Such laws always contain the provision against keeping or eating food in rooms where lead is worked over. Three newspaper plants, one in New York, one in Boston, and one in Philadelphia provide lunch rooms where hot food is offered for sale. Restaurants are also found in five large book and job houses in Cambridge, Boston, Philadelphia, Garden City (near New York), and Chicago.

METHODS OF CLEANING.

More care is needed in cleaning a printing shop than a factory where there is no lead in the dust. Dry sweeping of lead scraps and shavings and of lead dross which has been thrown on the floor will cause a contamination of the air with tiny particles of lead and this means a danger to the sweeper and to everyone else in the room. Even if the sweeping is done only after working hours it should never be done dry, for lead-laden dust may settle on the surfaces of the benches and cases, to be stirred up and blown about as soon as work starts up again. That the dust in a composing room is really mixed with quite appreciable quantities of lead may be seen in the report of Dr. Phelps on pp. 27, 28.

Dry sweeping during working hours is almost the rule in electrotype foundries, in stereotype foundries, in the monotype casting room, and around melting pots wherever they are placed. Usually it is not permitted around linotypes, or in the composing room, the men

rightly refusing to be exposed to the risk of this dust. Two well-managed book and job houses, one in Chicago and one in Cambridge, have no dry sweeping, all sweeping being done with wet sawdust, while two Philadelphia shops use a specially prepared oily sawdust. In some plants the floor is treated with oil often enough to keep down the dust, this being the case in two Baltimore job offices and a newspaper composing room, in a St. Louis job house, and in a Washington newspaper office. A newspaper office in St. Louis has the floors mopped once a week; a large book and job printing shop in Chicago, with cement floors, has them mopped twice a week; and another large shop in Chicago has no sweeping at all, only vacuum cleaning. The largest printing plant in Washington keeps the floors of the composing rooms in excellent condition by scrubbing every second day and sweeping every day with wet sawdust. The floor here is of wood over cement.

Strangely enough, more care is taken with the sweeping in the composing room than in the stereotyping and electrotyping departments and around the linotypes and monotype casters, where lead dust is so much more of a danger. For instance, in the Washington printing shop just referred to, while every effort is made to prevent lead dust in the composing room proper, the part devoted to linotypes is scattered over with lead fragments which catch in the rough edges of the metal covering the floor, while the sweeping is done dry and is far from thorough. Much worse is the condition in the other departments, for the heaps of scrap around the routers and the monotype casters and the dross around the electrotype and stereotype pots are swept up from time to time all through the day, with no attempt to prevent dust. If there is any place where a vacuum cleaner would be valuable it is in one of these foundries.

SPITTOONS.

The problem of cleanliness includes the prevention of spitting on the floor. This is a feature to which the health committees of the unions have paid special attention, and with good results. Several printing offices were visited in which spittoons were not needed. The floors were kept in excellent condition, and the men were not given to chewing tobacco and had not the habit of spitting, a habit which is often quite as unnecessary for men as for women. In other places spittoons were provided in large numbers and were well cared for, emptied daily, disinfected, and filled with some germicidal solution. These are, however, exceptional shops. More often spittoons are neglected and filthy; and though it would be quite inaccurate to say that a dirty spittoon is a menace to health, still it is certainly true that dirty spittoons go with dirty floors and general neglect, and in such places the men are likely to grow careless

and spit on the floor or on the walls. The best way to prevent this is to have walls and floor scrupulously clean, for men of the class of life from which printers are drawn will not deliberately or even carelessly defile a clean floor by spitting on it.

STANDARDS OF CLEANLINESS.

Standards of cleanliness in American printing offices are certainly much higher than they were formerly. Not many badly neglected places were seen in the course of this investigation; by far the greater number were fairly clean, and a goodly number were beautifully clean in most of the departments. The standards are, of course, largely dependent on the character of the man in charge, and it is by no means always the small and cheap plants that are the most neglected. There is a building in Chicago in which the two extremes of neglect and care may be seen on two successive stories. Both are one-room shops, the first a dark, crowded, dirty place, with rolls of black dust in corners, windows blackened with dirt and all tightly shut, ceiling and walls blackened, lights few and unshaded, a dirty sink with cold water, one much used roller towel, and no spittoons. The type cases are blown free from dust right in the room itself. In the next story is the second shop. This one is light, because walls and ceilings are white and the windows are clean. Floor and cases are free from dust, the latter being cleaned with a vacuum cleaner. The ventilation is not sufficient, but is helped by the belts of the presses. There is a clean sink, with individual towels, and there was no sign of spitting on the floor.

Many foreign countries require a certain standard of cleanliness in printing establishments and specify how often they must be cleaned and even painted or whitewashed. Thus in Holland floors must be wet-cleaned, either with mop or scrubbing brush, at least once a week unless a dust-binding oil is used. The walls must be washed or whitened once in 15 months. In Switzerland floors and furniture must be wiped daily with a wet cloth, walls whitened or washed once a year. The floor under frames and racks must also be washed. The German law specifies that the floor must be of some impervious material which can be wet-cleaned, the ceilings and walls covered with oil paint which will permit of their being washed down once a year, or else they are to be whitewashed once a year. The racks and frames in the composing room must either be built flush with the floor or high enough to permit of being swept under. The floor must be washed or mopped once a day, and all furniture must be thoroughly cleaned twice a year. Among the foreign regulations governing the management of printing offices we have selected the Norwegian as perhaps the best.

Norway's regulations, briefly stated, are as follows:

1. The floor must be washed weekly with warm water and soft soap and all furniture and other surfaces (this includes stoves) wiped off with a wet cloth. The floor must be smooth and must either be painted or finished with an oil that is not sticky. The cases, cabinets, etc., must be so placed that there are no spaces between them which can not be reached for cleaning.

2. Daily, after work is over, the floor must be wiped with a wet cloth. No person under 18 years may do the cleaning.

3. Windows and window sills must be washed once a month.

4. Twice a year there must be a house cleaning, all the furniture thoroughly cleaned, type cases removed and made dust free, walls and ceilings washed or covered with whitewash.

5. There must be one spittoon for each workman, filled with water, and emptied and cleaned daily.

6. Type cases must be cleaned at least every three months by an adult workman outside the workroom in the open air. He must protect his nose and mouth while he does it.

7. In the composing room there must be enough water, soap, and towels to enable each compositor to wash easily. Soap and towels are to be supplied by the employer. Compositors must wash before eating lunch and before quitting work.

8. The temperature of the room at the level of a man's head must be between 14° and 16° Réaumur (63.5° and 68° F.). There must be proper provisions for heating and ventilating in charge of a competent person.

9. The room should be ventilated, preferably by cross draft, at noon and after work. Smoking is forbidden.

These regulations were promulgated in 1896, and in 1907 this further provision was added:

10. The melting pot for linotype metal must be so arranged as to prevent heat radiation as much as possible. Gases must be drawn away from the workroom.

COMPOSITION OF TYPE METAL.

Type metal is an alloy of lead, containing tin and sometimes copper in varying proportions.

According to Southward's Modern Printing (London, 1900), English type metal contains about 50 to 69 per cent lead, 18.8 to 25 per cent antimony, 9.1 to 25 per cent tin, and sometimes 1.5 per cent copper. The formula for American type metal, according to the same authority, is the following: Lead, 100 parts; antimony, 35 parts; tin, 15 parts; copper, 4 parts.

No one formula is really typical of the alloy used in any country. The proportions vary not only for the different uses—linotype, stereo-

type, and monotype metal, etc.—but from shop to shop. Usually linotype metal is soft, i. e., rich in lead and poor in antimony, while stereotype metal has more antimony and monotype metal still more. Occasionally, however, only one mixture is made and it is used both for linotyping and stereotyping.

The proportions used are kept secret, but the foreman of a stereotype foundry gave some information concerning stereotype metal. Theoretically, he said, the mixture was supposed to be the following: Lead, 75 parts; antimony, 16 parts; tin, 9 parts. As a matter of fact, however, tin is too expensive to be used in such large quantities, and the real composition of the alloy is more likely to be this: Lead, 85 parts; antimony, 13 parts; tin, 2 parts.

Dr. Earle B. Phelps, of the Public Health Service, analyzed the various type metals used in the Government Printing Office and found their composition as follows:

Metal.	Melting point.	Lead.	Antimony.	Tin.	Arsenic.	Copper.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Linotype	237° C. [459° F.]	84.3	9.5	4.4	+	+
Monotype	236° C. [457° F.]	75.3	16.3	6.9	+	+
Electrotype	265° C. [509° F.]	91.9	3.0	4.1	+	+
Stereotype	236° C. [457° F.]	77.2	14.7	5.7	+	+

EFFECTS OF LEAD IN FUMES.

It is difficult to say how much exposure there is to lead poisoning in the printing trades because there is such wide difference of opinion among the authorities as to whether or not lead fumes are given off from the melting pots of the linotype machines, or from the monotype casting pots, or from the melting pots in stereotyping and in electrotyping. Some authorities are willing to say quite positively that no lead fumes are given off from such molten lead, and that the only danger is from lead dust, although they advise the placing of hoods over all melting pots. On the other hand De Vooys thinks there is actually an increase of lead poisoning since the introduction of the linotype. Carozzi also believes that linotypists suffer from the combined effects of lead and of nervous strain. Hahn reports that in 1907 the central committee of linotypists in Germany asked for an inquiry as to the possibility of lead poisoning from the machines, for they claimed that the introduction of machine work had not done away with this danger as had been expected. Out of 3,002 linotypists 55 believed that they had contracted lead poisoning during work on machines, but Hahn himself, after studying the question, came to the conclusion that the symptoms they complained of were caused by eye strain and possibly by lead dust and by gas fumes from the heating apparatus, but not by the fumes of lead. One of

the Austrian authorities upon lead poisoning, Etz,[1] says it is quite impossible that linotypists could be poisoned through fumes from the melting pots, for lead is best cast when it is only a little over its melting point, 330° C. (626° F.); a higher temperature makes it too brittle. Etz thinks that the only danger of lead poisoning in this sort of work comes from skimming off the oxide, the dross, and throwing it into a receptacle. If this is not done with care, the oxide turns to dust and may contaminate the air.

According to Legge and Goadby[2] also, the danger in the printing industry is greatest in work involving the handling of molten lead, but this comes not from fumes—there is no evolution of fumes from such metal—but from lead dust. This dust can be seen on the surface of linotype magazines. There should always be a receptacle for dross; it should not be thrown on the floor.

Silberstein[3] quotes Sternberg, who was for many years in charge of the workmen's sickness insurance in Vienna, as holding that there is no danger of lead fumes in the printing trades, since the melting point of lead is 320° to 330° C. (608° to 626° F.), and the vaporizing point between 1,000° and 1,500° C. (1,832° and 2,732° F.). The fumes which are seen to rise from melting pots consist of acrolein, from the fat and oil in the ink. The danger in this work, melting old type, is really from lead dust. Stereotypers are exposed to the same dangers as type founders except that there is not so much dust, because the type does not have to be finished by rubbing and filing.

It seems that the law in Germany (a measure passed by the Bundesrath in 1895) assumes that fumes may come from melting pots used for casting type, and prescribes precautions which must be taken against such fumes. This might, obviously, be applied to the pots in linotype machines, but apparently it has not generally been applied to them, and hoods are not always required for these machines.

Various attempts have been made to decide this question positively by testing the air of printing establishments in order to detect lead. Roth's experiments are quoted in the Austrian governmental report.[4] He examined 10 liters (610 cubic inches) of air collected over a kettle in which the lead was at 550° C. (1,022° F.), but he could find no lead at all. Only after a temperature of 650° C. (1,202° F.) had been reached was lead detected, and, inasmuch as the metal in the linotype machines can not be heated over 360° C. (680° F.) without injury to the machine, Roth concludes that there is no danger of fumes from this source. Sommerfeld[5] examined the air collected

[1] Etz, in Leymann's Bekämpfung d. Bleigefahr in d. Industrie. Jena, 1908, p. 214.
[2] Lead Poisoning and Lead Absorption. London, 1912.
[3] Weyl's Handbuch der Arbeiterkrankheiten. Jena, 1908.
[4] Bleivergiftungen in hüttenmännischen und gewerblichen Betrieben, in k. k. Arbeitsstatistisches Amt im Handelsministerium. Vienna, 1909, Vol. VII.
[5] Sommerfeld, in Leymann's Bekämpfung d. Bleigefahr in d. Industrie. Jena, 1908, p. 220.

close to a type-casting machine in the Government printing shop in Berlin. The lead was at a temperature of 400° to 450° C. (752° to 842° F.) throughout the experiment, and not the slightest trace of lead could be found in 60 cubic meters (2,119 cubic feet) of air. Nevertheless, Sommerfeld believes that there is some danger in connection with these melting pots, because even if lead is not vaporized at the temperature maintained it becomes very quickly covered with a layer of suboxide of lead, which is easily pulverized and blown into the air. Workmen near the pots, and especially if bending over them, might easily breathe in some of this light powder. Sommerfeld also thinks that melted lead is more dangerous when it contains some antimony, as is always the case with type metal.

Another analysis of air over a melting pot was made by Lewin.[1] He found that when the lead in the pots was kept at 500° to 520° C. (932° to 968° F.) no lead could be detected in the air, and only after the temperature had been raised to 800° or 900° C. (1,472° or 1,652° F.) could it be detected. Similar tests were made by Tischler[2] in the royal printing establishment in Vienna. He collected the air directly over the metal in a type-founding machine at 450° C. (842° F.). No trace of lead or antimony was found in 100 liters (3.5 cubic feet) of air. The same negative result was obtained from air collected over a melting pot for old metal which was at 470° C. (878° F.). Only when the heat in a stereotype metal pot was much over 500° C. (932° F.) did he find in 100 liters (3.5 cubic feet) of air 0.25 milligram (0.004 grain) of lead and 0.16 to 0.21 milligram (0.002 to 0.003 grain) of antimony. It is a pity that Tischler does not give any more specific statement than this as to the degree of temperature in the metal which produced positive results.

So far as can be gathered from the descriptions these experiments were all done with the molten lead at rest. Now, if one watches the work at a melting pot it is easy to see that while the lead is undisturbed there are no visible fumes given off, but as soon as it is stirred, or fresh lead dropped in, or the dross skimmed off, or if it is ladled or pumped out into molds and pans, a very distinct bluish cloud may be seen rising. This is what Sommerfeld referred to when he spoke of the oxide on the surface of the molten lead being easily dislodged and blown about by the currents of air rising from the heated metal. To determine this point by experiment it is obviously necessary to test the air while the lead is being agitated. This was done for this report by Dr. Earle B. Phelps, of the Hygienic Laboratory of the Public Health Service, who made a study of conditions obtaining in the Government Printing Office and then reproduced them in his

[1] Lewin, in Zeitschrift für Hygiene und Infektionskrankheiten. 1912, Vol. LXXII, pp. 154, 161.

[2] Bleivergiftungen in hüttenmännischen und gewerblichen Betrieben, in k. k. Arbeitsstatistisches Amt im Handelsministerium. Vienna, 1909, Vol. VII.

laboratory, using type metals of the same composition and raising them to the same temperatures as those found in the various metal pots. He also carried the temperature higher in order to cover those shops in which temperature variations are not well regulated and in which it sometimes happens that the lead is allowed to reach a heat decidedly higher than is necessary. He collected air for analysis while the molten metal was at rest and then again while it was being agitated.

Dr. Phelps summarizes his results as follows:

There is no detectable volatilization of lead within the range of temperature used at the Government Printing Office, nor at a considerably higher temperature, but even at the lowest temperature used there is a formation of oxide upon the surface of the molten metal, this oxide film being in the form of finely divided dust. It is more or less affected by mechanical agitation and may quite readily be carried away by currents of air. It is frequently in practice skimmed off as dross.

Under the conditions of these tests, and it is believed under conditions as observed at the Printing Office, this last effect is the only one deserving of serious attention. It is primarily a matter of mechanical agitation rather than of the temperature of the metal which determines the pollution of the surrounding air with this fine metallic dust.

In other words, molten lead as used in printing is at a temperature far below the volatilization point, and lead fumes, in the strict sense of the term, are not given off, but stirring or skimming or ladling out the metal disturbs the film of oxide constantly forming on the surface of the lead, and this is carried into the air so that there is a contamination of the air from lead as shown by actual test.[1]

This may be one reason why most of the foreign authorities who do not believe that lead fumes are a danger in printing, nevertheless, to be on the safe side, advise that all melting pots be provided with hoods. Legge and Goadby in Great Britain, Hahn in Germany, and the Austrian commission all consider this a desirable precaution. The Swiss law requires it.

Dr. Phelps's report of his experiments follows.

VOLATILITY TESTS OF METALS USED AT GOVERNMENT PRINTING OFFICE.

The problem was confined to the single question: To what extent are lead and lead compounds carried into the surrounding air from pots of molten type metal under the conditions of practice as found in the Government Printing Office. Four distinct types of process were inspected, namely, the linotype process, the monotype process, the stereotype process, and the electrotype process. In each of these cases a particular type-metal alloy is used.

In the first two named the metal is contained in small pots at each

[1] This is more freely discussed in the section on "Linotype machines" (p. 37 et seq.).

machine, while in the case of the electrotype and stereotype work the metal is contained in large pots from which it is ladled as used. It was decided to secure specimens of these four type metals and to submit them to study at the Hygienic Laboratory under conditions that could be more accurately controlled and where a more careful investigation might be made. The apparatus arranged for this purpose may be briefly described as follows:

The metal in question was melted in a 2½-inch fused quartz crucible. This crucible was covered with a piece of asbestos perforated for the introduction of a thermometer and of an aspirator tube. This tube conducted the air from a point immediately over the surface of the molten metal through suitable absorption bulbs containing dilute nitric acid attached to the aspirator device. During the test, which was usually continued for several hours, quantities of air varying from 8 to 41 liters (488 to 2,502 cubic inches) were thus aspirated. Temperature readings were taken at frequent intervals and in most instances the metal was agitated from time to time as violently as possible by means of a glass stirring rod. It is believed that this agitation represents approximately the practical conditions maintaining at the Printing Office during the ladling process, or upon the addition of new bars of metal. In two cases more intense agitation was given by directing a small jet of air in the one case and of carbon dioxide in the other, directly beneath the surface of the metal. This blast was maintained continuously during the test. The contents of the absorption bulbs were withdrawn at the conclusion of the experiment, evaporated to dryness, and submitted to careful quantitative examination for lead, antimony, and tin. The tests were run over various temperature ranges and in all cases the temperatures were well above those used at the Printing Office.

A second trip of inspection was made to the Printing Office for the purpose of collecting information upon this point and temperatures of the various metals were taken. In the case of the small linotype and monotype pots some half-dozen temperatures were taken in each case. A complete chemical analysis of each of the metals investigated was also made and the melting points of each were determined.

The results of the experimental studies have been compiled and are shown in the table following.

TABLE 1.—VOLATILITY TESTS OF METALS USED IN GOVERNMENT PRINTING OFFICE.

Experiment number.	Metal.	Temperature.		Volume of air (liters).	Result—lead.	Remarks.
		Printing Office.	Test.			
1	Linotype	259° to 295° C. [498° to 563° F.]	268° to 290° C. [514° to 554° F.]	8.5	Negative	
2	do	259° to 295° C. [498° to 563° F.]	310° to 460° C. [590° to 860° F.]	8.0	0.00126 grain.	Air blast.
3	do	259° to 295° C. [498° to 563° F.]	294° to 320° C. [561° to 608° F.]	30.0	Negative	
5	do	259° to 295° C. [498° to 563° F.]	380° to 410° C. [716° to 770° F.]	36.0	0.00134 grain.	CO_2 blast. Sb. 0.00004
4	Monotype	378° to 416° C. [712° to 781° F.]	320° to 380° C. [608° to 716° F.]	28.0	Negative	
8	do	378° to 416° C. [712° to 781° F.]	454° to 508° C. [849° to 946° F.]	37.0	do	Sb. 0.00002
6	Stereotype	307° C. [585° F.]	340° to 400° C. [644° to 752° F.]	41.0	do	
7	Electrotype	370° C. [698° F.]	350° to 370° C. [662° to 698° F.]	34.0	do	

Negative lead results less than 0.00005 grain. Negative antimony results less than 0.00002 grain.

In stereotyping and in electrotyping temperatures higher than the above are sometimes found. The following tests were made to determine the contamination of the air with lead during an agitation of the metal at these higher temperatures such as would result from stirring it, or ladling, pumping, or skimming in the course of ordinary work.

Test No. 9 was made with stereotype metal at temperatures ranging from 440° to 512° C. (824° to 954° F.). Thirty-six liters (2.197 cubic inches) of air were drawn through this crucible, the metal being frequently agitated by stirring; 0.03 milligram (0.0005 grain) of lead and no antimony were found on analysis of this volume of air.

Test No. 10 was made with the electrotype metal under similar conditions, the temperature ranging from 445° to 520° C. (833° to 968° F.). Thirty-six liters (2,197 cubic inches) of air were drawn over the crucible containing this metal and the results of the analysis gave 0.04 milligram (0.0006 grain) of lead and no antimony.

PRESENCE OF LEAD IN DUST.

Whatever doubt there may be as to the presence of lead in the fumes from melting pots, there is no doubt that the air of the printing shop may become contaminated with lead dust in several ways. Cases in which type is kept contain dust with particles of lead in it and some of this escapes into the air when the type is shaken to get at the lower letters and especially when the cases are cleaned by blowing out the dust. This is generally recognized as a danger and some precautions are almost always taken, such as carrying the case which is to be blown out over to the window, or even on to the fire escape, or into the corridor. Around the linotypes and the machines for trimming, shaving, and routing stereotype plates and electrotype plates, there are quantities of lead scraps and filings which lie on the floor and are tracked about by the men passing to and fro. The same thing is true around the melting pots for used type. Even dustier is the dross that is skimmed from the various melting pots and very often thrown on the floor. Then at the end of the day's work the linotype machines are cleaned of lead scraps, sometimes by wiping, but much more often by brushing or blowing. In all of these ways particles of lead find their way into the air of the composing rooms and the stereotype and electrotype foundries.

Several analyses of dusts collected in various printing shops have been made and we have selected a few typical ones. The one most often quoted is Fromm's, reported in 1898.[1] He made his tests partly in the royal printing shops in Vienna and gives the following results:

Two tests of dust from type cases showed 38.77 per cent and 17.27 per cent, respectively, of lead.

Three tests of dust from floors and surfaces of rooms showed, respectively, 2.11 per cent, 1.83 per cent, and 2.43 per cent of lead.

[1] Fromm, in Hygien Rundschau. 1898, vol. 8, p. 465.

Fromm says that Pannwitz and Wegmann found the air in printing shops lead free, but he himself filtered it and found a small but appreciable percentage of lead in the dust thus gathered.

Carozzi [1] examined the dust of a printing shop in Milan and found two type cases to contain, respectively, 16.4 per cent and 28.8 per cent of lead; that from the surface of a type case 5.6 per cent; that from the floor of a composing room, 0.37 per cent; and that from the top of a stove, 0.24 per cent. The dust which had accumulated in a ventilator during two months' time contained 2.5 per cent of lead.

Legge and Goadby [2] say that the dust removed from a composing box by a vacuum cleaner was found in the Government laboratory to contain 9.8 per cent of metallic lead, and that collected from the top of the magazine of a lintoype machine 8.18 per cent.

Fabre made analyses in the royal printing establishment in Berlin in 1897.[3] He estimated first the dust in the air and found that during the 300 working days of the year a man would breathe about 186 milligrams (2.86 grains) of dust, but his analysis showed that there was only about 1.6 per cent of lead in this dust, which would make a little less than 3 milligrams (0.046 grain) of lead in a year's time. This he thinks too small a quantity to cause illness in an otherwise healthy man.

None of the analyses show a large proportion of lead in the dust from any source except the type cases, and this does not often find its way into the air of the rooms. Even in printing shops where type is used over and over again it is rare to find a place where a type case has to be blown out even as often as once a week. Nevertheless, the very small quantities of lead which are found in the dust from floors and other surfaces become of importance when one considers that the printers are breathing this air day after day, that lead is a slowly cumulative poison, and that it may show itself in a lowered resistance to infections even when it is not shown by any symptoms of typical poisoning.

TESTS FOR LEAD IN DUST.

Analyses of dust from different sources and from several printing shops in Washington were made by Dr. Earle B. Phelps, of the Public Health Service. As would be expected, the largest proportion of lead was found in that collected in type cases.

The specimens were examined in accordance with a procedure which involved the extraction of the sample by shaking for one hour at common temperature with 1,000 times the sample weight of

[1] Inchiesta igienico-sanitaria nell' industria poligrafica in Italia. Pubblicazione della Sezione Ital. dell' Associazione internaz. per la protezione legale dei lavoratori. 1908. Parte II.

[2] Lead Poisoning and Lead Absorption. London, 1912.

[3] Fabre, in Deutsche medicinische Wochenschrift. 1897, vol. 23, p. 568.

aqueous hydrochloric acid containing 0.25 per cent of HCl. The results are recorded in percentage of lead by weight. In each case, also, a qualitative test was obtained for antimony, and a distinct qualitative test was obtained for arsenic in the case of sample No. 6.

Samples of dust numbered 1, 2, and 3 were taken from three newspaper printing offices in Washington and contained, respectively, 0.51, 0.80, and 2.80 per cent of lead.

Samples numbered 4 and 5, which were from two commercial printing offices, showed, respectively, 0.20 and 5.68 per cent of lead.

Samples numbered 6 to 11, inclusive, were all taken from the Government Printing Office, and the original description of sources has been retained in the following paragraphs:

No. 6. Dust from open type case. Contained 5.68 per cent of lead.

No. 7. Dust from empty case, at a level of 2 feet from floor. Fine flocculent, mainly organic dust. Contained 0.64 per cent of lead.

No. 8. Dust from a "box" or compartment in a lower case, monotype. This dust contains microscopic particles of lead, as do all cases wherein monotype products are "laid." These particles of lead are too heavy to be air borne, except when (as occasionally occurs) the case is agitated. Fingers are soiled by such dust, and chewers of tobacco may convey such metal-contaminated fingers to the mouth. Contained 5.12 per cent of lead.

No. 9. This dust came from a "galley" rack, covered at top and exposed only at the front. This rack is about 4 feet high. The dust came from the two top shelves. This is fairly representative of the air-borne dusts in a modern composing room. The cabinet had been well cleaned about 10 months previous. Contained 0.72 per cent of lead.

No. 10. Dust from an old type case (lifted from the case and not shaken therefrom) at about 4 feet from the floor. This dust does not contain the heavier bits of lead usually found in type cases under the hand system. Contained 0.32 per cent of lead.

No. 11. Dust from cabinet tops, at or about 5 or 6 feet from floor. Such dust rises from sweeping and is not the result of abrasion of metal. Contained 0.64 per cent of lead.

EFFECTS OF OTHER POISONS.

ANTIMONY.

Next to lead the most important substance used in the printing trades, as regards the danger of poisoning, is antimony. Type metal consists of lead with the addition of varying quantities of antimony, and a small proportion of tin and sometimes copper. Many authors consider this addition of antimony as decidedly increasing the danger

of poisoning. Sommerfeld[1] says that he and other experienced observers find melted lead and antimony much more dangerous than lead alone, as such alloys generate harmful fumes at a comparatively low temperature, so that in the production and handling of type metal special caution is necessary even when no very high temperature is used. Whether antimony itself is more dangerous than lead, or whether it only favors the vaporizing of the latter, is not stated. Legge and Goadby[2] make the statement that lead melts at 325° C. (617° F.) and antimony at 630° C. (1,166° F.), but the addition of antimony to lead up to 14 per cent brings down the melting point to 247° C. (477° F.), after which further addition raises the melting point.

Lewin also believes that the addition of other metals to lead results in volatilization at a lower temperature.[3] Roth calls attention to another danger in the use of antimony and that is that commercial antimony almost always contains arsenic, sometimes a large proportion.[4] This is also true of American antimony, according to a smelting expert, who says that practically all the antimony used in type metal in the United States contains some arsenic.

A few writers have tried to make the antimony in type metal responsible for a well-marked and characteristic form of poisoning among printers. The article of Schrumpf and Zabel[5] is often quoted in this connection. They believe that there is very little lead poisoning among printers, but that there is a clearly defined malady which is very common and which they consider an early stage of antimony poisoning. They believe that no less than 20 per cent of printers suffer from this and that it is especially common among young apprentices. The symptoms they describe are such as might be attributed to severe nervous strain, bad air, and lack of exercise, and are improved by exercise in the open air.

A Dublin physician, McWalters,[6] published in 1910 an article on printer's palsy which he attributed not to lead but to chronic antimonial poisoning. He claimed to have seen cases of neuritis very like those which follow arsenical poisoning and which he believed were caused by antimony. He also quoted a report of the British chief inspector of factories for 1900 in which are described cases of antimonial poisoning in the extraction of the metal which were similar to McWalters's cases in printers.

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[1] Sommerfeld, in Leymann's Bekämpfung d. Bleigefahr in d. Industrie. Jena, 1908. p. 220.

[2] Lead Poisoning and Lead Absorption. London, 1912.

[3] Lewin, in Zeitschrift für Hygiene und Infektionskrankheiten. 1912. Vol. LXXII, pp. 154, 161.

[4] Roth: Kompendium der Gewerbekrankheiten. Berlin, 1909, p. 79.

[5] Schrumpf and Zabel, in Archiv für experimentalische Pathologie und Pharmakologie. 1910, vol. 63, p. 242.

[6] McWalters, in Medical Press and Circular. London, 1910, n. s., Vol. XC, p. 160.

The truth is that the symptoms of poisoning from arsenic, antimony, and lead are similar in many respects, and when all three metals are in use together it is almost impossible to decide which one is wholly or chiefly responsible in any given case of poisoning.

Skin affections from arsenic or antimony are spoken of in the foreign literature, but they are not common among printers in the United States. Only two severe cases of eczema of the hands and forearms were seen in the course of this inquiry, both in men who were working with molten metal. In the examinations of printers made by Dr. Palmer and Dr. Ellis (p. 91), only a few cases of skin affections were found, none of them severe.

Carozzi found very little skin disease among his 600 printers, and believes that antimonial poisoning is of no practical importance in this trade.

TYPE AND ROLLER CLEANERS.

The substances used in cleaning type—benzine, kerosene, and lye—often give rise to rather distressing inflammation of the skin. Turpentine is rarely used for this purpose in our country, except sometimes for badly "gummed" forms, because it is too expensive, but in Germany, where an impure variety is largely used, a good deal of trouble has been caused. In Berlin in 1913 there was a sudden increase in the number of applications to the printers' sickness insurance office by men who were suffering from a severe dermatitis of hands and forearms. The condition was very like that caused by burning or scalding, a tense, reddened, hot skin with blisters and later scaling and a condition like eczema. In one shop 5 out of the 12 men who had been cleaning type had had this form of skin disease. Investigation showed that they were using an impure turpentine adulterated with benzol. Two physicians, Zellner and Wolff,[1] collected 37 samples of the type-cleaning fluids used in Berlin and found that 32 contained some substance harmful to the skin. Among these were benzine, especially the lighter forms, benzol, which is more irritating than benzine, and pine oils, which are still more so.

In American printing a great deal of petroleum—coal oil, naphtha, benzine—is used in cleaning press rollers and type forms. Some men are sensitive to the local effect of these substances on the skin and also to the fumes, which cause dizziness and headache. Benzine and naphtha are more volatile than kerosene, but the latter is said to be more likely to cause acne. One large office in Philadelphia gave up the use of coal oil as a wash because of its effect on the skin.

Lye, which is almost invariably used for thorough cleaning of old type and forms, is very caustic and irritating to the skin and has a disadvantage not found in benzine because as it dries it leaves

[1] Zellner and Wolff, in Zeitschrift für Hygiene und Infektionskrankheiten. 1913, Vol. LXXV, p. 69.

on the type a thin coating of potash unless it has been very thoroughly washed off, and this irritates the skin of the typesetters, causing cracking of the skin on the ends of the fingers, and the powder may irritate the eyes and nose.

Printers differ very much in their susceptibility to these so-called trade eczemas. Some of them can not stand contact with even mild irritants, while others do not suffer at all. That skin diseases are, on the whole, more common in the trade in Germany than among occupied males in general is shown by the statistics for Berlin.

Pieraccini and Casagli[1] report from Italian printing shops an affection of the index finger and thumb, which is probably purely mechanical, an ulceration, torpid and slow to heal, caused originally by many tiny injuries to the skin made by the edges of the type. These injuries result in fissures, which become infected and suppurate. The authors even suggest that the process may be regarded as a local form of lead poisoning from tiny spicules of lead entering the skin.

A rare but serious form of poisoning in the printing trade is anilinism. This has only quite recently come into notice, and no mention of it is to be found in the foreign literature. So far as we know, the first report of aniline poisoning in the printing trade was made by Dr. G. L. Apfelbach, in the bulletin of the State of Illinois Department of Factory Inspection, in 1913. The man was a press feeder, who had been using a new sort of roller wash to remove the ink from the press rollers. It was a black, oily fluid, which Dr. Apfelbach found on analysis to contain aniline oil. On the day when he was seen by the factory inspector he had cleaned more rollers than usual, and both his fellow workmen and the inspector noticed that his face, lips, and tongue were a deep blue. He said that he had noticed a curious pallor on former occasions when he used this black fluid, but that it had never been as bad as at this time. The only symptoms he complained of were headache, chiefly at the back of the head, dizziness, pain in the stomach, dryness in the throat, and difficulty in swallowing, but none of them severe enough to alarm him at all. It was the startling change in color that sent him to seek medical advice.

More serious cases than this were found by Dr. E. R. Hayhurst in the course of a survey of occupational diseases in Ohio, made for the State board of health.[2] His inspectors were told of several instances in which men using roller washes, rich in aniline oil, had lost consciousness and were with difficulty revived after several hours. They also were deeply cyanosed.

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[1] Pieraccini and Casagli, in Il Ramazzini. 1910, vol. 4, p. 608.

[2] Ohio State Board of Health. Industrial health hazards and occupational diseases in Ohio, by E. R. Hayhurst, A. M., M. D., director, division of occupational diseases, Ohio State Board of Health. Columbus, Ohio, February, 1915, pp. 189, 208, 210.

In these cases the first symptom is usually a sudden flushing of the face, which later turns deep blue in color. The man feels hot, his head is full, he feels confused and dizzy, a severe headache usually comes on, and a sense of weakness and apprehension; he may also feel nausea. If he goes out in the open air these symptoms may disappear, but on the other hand, in almost all the instances in which loss of consciousness is recorded, this came on some time after the man had left his work. Examination shows that there are changes in the blood due to the formation of methæmoglobin which, in contrast to oxyhæmoglobin, forms a firm combination with oxygen and does not release it to the tissues. This means that there is a condition of starvation for oxygen, a condition usually described as "internal suffocation," for it is really just as if the man were being slowly strangled. The oxygen is present in the blood in sufficient quantity, but the tissues can not avail themselves of it because it is bound to the methæmoglobin. The blood shows the effect of compensating efforts made by the blood-building organs, for there is an increase in the red-blood corpuscles and immature forms are seen. The urine contains products of the breakdown of red-blood corpuscles and also methæmoglobin and the odor of aniline may sometimes be noticed. In chronic cases, anemia sets in.

Other substances said to enter into the composition of roller washes are wood alcohol and carbon tetrachloride or tetrachlormethane. This last is a noninflammable solvent for fats and is said to be the active constituent of some of the noninflammable washes which are advertised. It is closely allied to chloroform and has much the same effect on human beings, only that it is more irritating to the throat and eyes and the effect on the nervous system comes on more slowly and passes off more slowly. It is not probable that in the quantity used in roller washing a man would absorb enough to cause loss of consciousness, but the milder symptoms of headache, dizziness, dullness of mentality, loss of appetite, and nausea would be quite possible.

Wood alcohol or methyl alcohol is always a dangerous compound to work with, for not only are its effects those of a narcotic poison but it has a selective action on the optic nerve, and many cases of blindness, partial or complete, have resulted from its use in industry. It is used also in electrotype foundries to clean plates.

ACROLEIN.[1]

In the discussion of the character of the fumes from melting pots, it was stated that the thick, choking clouds that come rolling out when used type and old linotype metal and monotype metal

[1] Acrolein is an unsaturated aldehyde, acrylic aldehyde, with the formula $CH_2 : CH.CHO$. It is produced when fats are heated to the decomposition point and has a peculiarly pungent, suffocating odor.

and stereotype plates are being melted down, are not clouds of lead fume, but chiefly acrolein, a fat-decomposition product from the oil in the dried ink.[1] It would be a mistake, however, to conclude that because these fumes are free from lead, they are therefore harmless. On the contrary, acrolein is decidedly poisonous. Cases are not unknown in this country of workmen becoming seriously affected by these fumes. In the largest printing shop in Washington there are four melting pots in a room which opens by a wide doorway into the stereotype room. The windows are opposite this door and whenever it is left open, the fumes which rise when used type is being melted down can pour into the stereotype room. Sometimes when the fumes are unusually thick and the wind is on that side, the air in the latter room has become so poisonous as to overcome the men working near the door and they have had to be helped to the fire escape to get over the effects.

Lewin,[2] who experimented with acrolein vapors on himself, reported that he experienced an irritation of the mucous membranes of the nose and throat, that he could breathe without difficulty if the fumes were weak, but as soon as they were at all concentrated he had the instinctive desire to hold his breath for fear of filling his lungs with them. After a while he grew dizzy and confused, with a sense of pressure in his head, and if he remained longer in this atmosphere, a distressing catarrh of the throat came on, extending to the larynx and bronchial tubes, also a feeling of oppression in the stomach, with slight pain and diarrhea.

Iwanoff[3] experimented with animals and found acrolein very poisonous, even small doses (1.5 milligrams for a cat) causing death with œdema and hemorrhage of the lungs.

CARBON MONOXIDE GAS.

Wherever illuminating gas is used for the purpose of producing heat there is danger that the air around may become contaminated by gases given off when combustion is not complete. The important one of these gases is carbon monoxide, a colorless, odorless, extremely poisonous body. The presence of five-tenths part of carbon monoxide in 1,000 parts of atmospheric air marks the beginning of danger, and 2 or 3 parts per 1,000 are perilous to life.[4]

Many cases of acute industrial poisoning from this gas are recorded, as, for instance, in the annual report of the chief inspector of factories and workshops in Great Britain for the year 1907, when

[1] Legge and Goadby: Lead Poisoning and Lead Absorption. London, 1912, p. 253. Silberstein, in Weyl's Handbuch der Arbeiterkrankheiten. Jena, 1908, p. 353.
[2] Lewin: Archihv für experimentelle Pathologie und Pharmakologie, 1900.
[3] Iwanoff, in Archiv für Hygiene. 1911, vol. 73, p. 307.
[4] J. Rambousek: Gewerbliche Vergiftungen. Leipzig, 1911, p. 251.

81 cases, with 10 deaths, occurred. It is, however, the slow, chronic form of poisoning which interests us, that which results from long-continued exposure to minute quantities. The poisonousness of carbon monoxide consists in the fact that it has a great affinity for the coloring matter of the blood, two hundred times as strong an affinity as has oxygen, so that very small quantities in the air will be taken up by the hæmoglobin of the blood. Carbon monoxide thus replaces the oxygen in the blood, and as a result the tissues are more or less starved for oxygen. Anemia, with its attendant lowered nutrition and loss of strength, sets in. There is also a direct effect on the nervous system, shown by headaches, distaste for food, dizziness, mental dullness and lassitude, sleepiness, and palpitation of the heart.

This form of poisoning has been described by Epstein,[1] as found in bakers, working over gas-heated ovens, and still more frequently in tailors, both the pressers who use gas flames to heat their irons and the men and women who work in the same room with them. Factory inspectors in Berlin found tailor shops in which the air contained dangerous quantities of carbon monoxide, 0.19 and 0.29 per cent. Epstein describes the symptoms of chronic exposure as headache and dulling of the intellectual powers. The headache may recur whenever the gas-vitiated atmosphere is encountered and may promptly disappear in the open air. Provision of fresh air in the workshops does away with this trouble.

Carbon monoxide gas is probably present in all departments of a printing shop where gas is used to melt lead—in the linotype casting, monotype casting, remelting of old metal, stereotype casting, and electrotyping, unless over the gas burners a good draft has been provided to carry off these fumes.

THE COMPOSING ROOM.

The dangers in the work of the typesetter should be limited to the handling of lead type. That risk is inherent in the trade and can not be eliminated. But if this were the only risk, then it would be possible to protect the compositor fully from all danger of the effects, subtle and slow, of chronic lead absorption, simply by providing him with ample washing facilities. If then he still showed signs of lead absorption, we could assume that he was eating his lunch with unwashed hands or conveying lead to his mouth by handling his chewing tobacco with unwashed hands and that he had only himself to blame. The case is, however, not nearly so simple as that. The typesetter may be a man of scrupulously cleanly habits and he may yet be subject to poisoning from minute quantities of lead in the course of his work, because there is lead dust in the room

[1] Epstein, in Weyl's Handbuch der Arbeiterkrankheiten. Jena, 1908, pp. 413, 502.

where he works or because he has to blow out old type cases or work near a melting pot or a pile of lead dross which is blown about by drafts of air.

Pannwitz[1] says that the chief evils in the typesetter's trade are all preventable. They are the lack of space, overcrowding, insufficient cleanliness of the work place, insufficient ventilation, and abundant production of dust. If the composing room is kept clean and well aired and if nothing is carried on there but hand composition—conditions which are not imaginary but are found in many of the best shops—then there should be no more risk to health for the typesetter of good personal habits than for any other worker at an indoor and mentally exacting trade.

Cleaning dust out of the type cases is recognized by experienced printers as a source of lead poisoning and almost never will the men allow it to be done in the composing room unless the case is at least carried to a window. More often it is taken to a fire escape or out on the roof or on the stairway. In newspaper offices very little of this work has to be done and in many job shops less and less is done every year. Usually the compositors do the work themselves, but sometimes they give it to the apprentices. The amount of lead contained in this dust can be seen in the results of Dr. Phelps's analyses on pages 27 and 28. The usual method is to use a bellows, but sometimes a current of compressed air, which is essentially the same, is used. This is dusty and dangerous work, so regarded in every country, and the only way to prevent the danger is to use a vacuum cleaner. Four shops in Chicago, two in St. Louis, and one each in Philadelphia, Cambridge, and Washington use this method. Many foremen when asked about the possibility of vacuum cleaning answer that it would not work because the suction would draw in the type, but where the suction is strong enough to do this a wire screen may be laid over the type and in most places a weaker suction is used. A combined brush and suction pipe was seen in use in the royal printing office in Holland, and from the literature it seems that a similar one is used in France. This consists of a flat brush with stiff bristles, fastened to the pipe of the vacuum cleaner in such a way that the opening of the pipe is in the center of the brush. The operator presses this brush down on the type in the case and rubs it to and fro, stirring up the dust and brushing off the type, and the suction in the pipe carries the dust away.

A bad feature, already mentioned, in many shops is bringing other processes, productive of lead dust and lead oxide from molten metal, into the composing room, and exposing the typesetters to dangers which are quite unnecessary. It is very common, especially in newspaper offices, to find the linotypes in the composing room. One of

[1] Pannwitz, in Arbeiten aus dem kaiserlichen Gesundheitsamt, 1896, Vol. XII, p. 686.

the best newspaper offices visited in Philadelphia has a composing room which is excellent in every respect except this one. Even though no lead fumes arise from the linotype pots there is certainly contamination of the air by gas from the machines, unless these are well protected, and by the lead scrap which is continually dropping on the floor and being tracked over it.

Saws, with quantities of lead scrap on the floor, were found in the composing rooms of two large Boston printing shops. Even worse is the melting pot for old linotype metal, which is sometimes the one thing that spoils an otherwise clean and safe composing room. A large New York newspaper and another in Philadelphia have placed their melting pots in the composing room, and allow piles of used type and of sweepings from under the machines to lie on the floor near the kettle. In the Philadelphia plant two boys were working at this kettle, one gathering up and dumping the used type and scrap, the other shoveling it into the kettle through a feed door 18 inches square, and as there was only a natural draft in the hood over the pot, fumes could be seen escaping from this door. No intelligent compositor should be willing to put up with such an unnecessary risk as that. In two Baltimore newspaper composing rooms remelting and casting are carried on, but strong suction fans have been installed in the walls near the pots, and the fumes do not spread into the rest of the room. Putting the steam tables for the making of matrices in the composing room does not add to the danger, but adds a good deal to the discomfort, and is unfortunately very often seen. The heat and humidity caused by this work are great enough to require that it be done in a separate room.

The frames or wooden stands, in composing rooms, at which the compositors work have sloping tops on which cases of type are placed. The frames may be fitted with racks on which the stock cases or the galleys of type can slide, and may either be open or closed. Cabinets are now much used instead of frames, and the cases are the drawers of the cabinet. Sometimes, in the newer shops, this furniture is of metal, but usually it is of wood. Closed cases are preferable to the open, because the type is kept free from dust and they do not need blowing out. A feature to be noted is the possibility of cleaning easily around or under cabinets and frames. Either they should be built flush with the floor so that no dust can collect under them or they should be raised high enough to allow of being swept under. The usual height, about 3 or 4 inches, is bad, for it means that no sweeping is done under the cabinet or that the boy must go down on his hands and knees and use a brush, something that should not be done in printing shops, where the dust may contain lead.

It must be remembered that the work of setting type, and that of

the other processes connected with it, is rather exacting in itself and should be carried on in surroundings as favorable as possible. At the best, the typesetter is working at an occupation which requires much standing in one position, a position which cramps his chest and favors an unequal development of the two sides of his body; he has far too little muscular exercise and a disproportionate amount of nervous tension and eyestrain.[1] For these reasons a meticulous attention to sanitary details is justified in printing shops.

There are some ideal composing rooms in the seven cities visited, rooms which their owners regard with a justifiable pride, but the majority are open to criticism in various features either of construction or upkeep.

LINOTYPE MACHINES.

The linotype is a machine which casts a solid line of type known as a "slug." The operator presses the keys on the keyboard and one brass matrix after another passes through a channel from a portable magazine to an assembler where space bands mechanically wedge the line tightly. The molten lead is then forced in a jet from the pot by a plunger, and fills the characters which are countersunk in the sides of the brass matrices. The lead hardens almost immediately and a line of type has been cast. Then the space bands separate, the matrices are automatically distributed to their proper receptacles, and the finished slug is deposited on a specially provided galley.

For our purpose the important features connected with the linotype are the melting pot with its heating apparatus and the lead scrap which falls from the machine while it is in use. The method of cleaning the machine and of cleaning the plunger is important also. Then it is a matter of great interest to know whether any device is installed to carry off fumes generated in heating the melting pots and, if there is such a device, whether it is really efficient.

Dr. Phelps's experiments show that no lead fumes are given off from molten lead at temperatures such as are found in the various processes of printing unless the lead is vigorously agitated. In linotype machine operation no such agitation takes place. The pot tips slightly and the plunger drops, but that is all. Except when dross is skimmed and dropped on the floor it is highly improbable that any detachment of lead oxide occurs in linotype work which could cause any appreciable contamination of the air.

To prove that there are no lead fumes from linotype pots is not to prove that work on these machines is without risk to health nor

[1] Some idea of the complexity of linotype work may be gained when one considers that the newer machines have from four to eight faces of type and that the standard of work in a newspaper office is 3,500 ems an hour. A bonus is paid for every 500 ems in excess of this.

even that there is no risk from lead poisoning. There are many sources of possible lead poisoning in machine composition as it is usually carried on, and it is not hard to find justification for the disappointment that was experienced when it was found that the introduction of mechanical typesetting and the displacement of handwork had not resulted in the abolition of lead poisoning as had been claimed.

There are many sources of lead dust in this work. While work is going on lead in the form of cuttings and powder keeps falling to the floor and accumulates in a heap under the machines. Usually it lies there till the day's work or the night's work is over and then it is swept up and taken to the melting pot, but sometimes sweeping goes on while the operator is working. In any case men are continually passing to and fro grinding this lead into dust and tracking it over the floor, and the finer parts are lifted by drafts of air and can easily be wiped from the surfaces of the magazine.

In the royal printing establishment at The Hague there are 12 linotypes in one room, all provided with hoods and with artificial suction, but the best feature is a metal pan which is so shaped as to fit accurately around the standard of the machine so that it can catch all the fragments of lead. The floor is of yellow tiles and the bits of lead would show quite clearly on it, but at the time a visit was made the pans were well filled and no fragments of lead had fallen on the tiles. At the end of the day it is a very simple thing to lift these pans and carry them off to be emptied. In a few of the printing shops in this country metal pans have been placed under the machines. One of the New York newspapers has some that are fairly good; so have two Philadelphia papers and one in Boston; but only part of the scraps are caught, for the pans are not fitted to the standards of the machines, simply placed where they can catch some of the falling lead and they do not help much to solve the dust problem. Indeed, the standards of many American machines are so complicated that it would seem impossible to make a pan which would fit into the irregularities. In other places there is a low wooden ledge nailed to the floor around the bottom of the machine, or perhaps the floor here is sunk an inch or more below the surrounding level, to catch the lead scrap and keep it from scattering. Apparently such an arrangement is not really effective and it certainly adds to the dustiness of the work of sweeping and gathering up the scrap which always collects along the edges. This is not the only source of lead dust in the linotype room. A feature that was spoken of in the description of the composing room as adding to the danger quite unnecessarily is found also in connection with the linotypes, and that is the placing of the melting pot for remelting linotype metal and casting the "biscuits" of lead in the same room with the machines, some-

times quite close to them. This may mean contamination of the air with lead oxide if the melting is done during working hours, and even if it is not, it means that great piles of lead scrap are allowed to lie on the floor and add to the danger from dust. In a Boston job printing shop the kettle boy opens the melting pot every 20 minutes to skim off the dross and shovel in more lead scrap, letting dust escape each time, for the draft in the hood is far from strong. Still worse is the arrangement in a newspaper composing room, also in Boston, where a linotypist works within a few feet of the chute for lead scrap which comes down from the floor above. Not only the melting pot for linotype metal is here but a small furnace for refining dross, and once a week this is in use and as the temperature must be at least 900° F. and the hood must be raised from time to time to remove the scum and to feed in the very dusty charges of dross, it is easy to see the risk of lead poisoning to which this operator is exposed, a risk with which his actual work has absolutely nothing to do.

In a Philadelphia job shop conditions were found which might lead to lead poisoning. The room in which the linotypes are placed is dirty and the floor, of rough wood, is full of scraps of lead. There is no artificial ventilation and the only windows, at one end of the room, open on an air shaft. In this place the melting pot has no hood at all, only a lid which can not be put on till the piled-up lead scraps in the pot have melted down to below the level of the edge, and after that the lid must be raised from time to time to skim off dross and to shovel in more lead. According to the men employed here there is always some "smoke" escaping. Another Philadelphia job shop has 30 persons, 5 of them women, employed in one room which has not only piles of dusty lead scrap but a melting pot and stereotype kettle, the latter provided only with a hood, placed too high, a small pipe and a broken fan. In a Washington job shop the melting pot is within 5 feet of a make-up man and within 8 feet of a linotype operator.

It is not necessarily dangerous to have remelting done in the same room with linotype work, provided proper precautions are taken. In a St. Louis newspaper plant the pot is placed over in a corner beside a window; the hood is excellent, and when once lowered is not raised while melting is going on, for the lead runs out to covered molds. The scrap, instead of lying in heaps on the floor, is kept on trucks till needed. In other places where arrangements are not so good the melting is done outside of working hours, so that the operators are not exposed to dust and to possible fumes.

Other sources of possible lead poisoning for the linotype operator or for the machinist are found in the cleaning of the machine and of the plunger in the melting pot. In places where there are many ma-

chines a machinist has charge of keeping them in order and the operator has nothing to do except perhaps to feed in the lead "biscuits," but if there are only two or three or even four machines each operator takes entire charge of his own machine and is therefore exposed to a good deal of lead dust.

To clean out the scraps of lead which scatter through the different parts of the machine some men use compressed air, others blow them out with a pair of bellows, but in any case there must be some brushing with a soft brush or wiping with cloths. Then there is the cleaning of the plunger, which is much dustier, for the plunger is covered, not with scraps of metallic lead, but with a fine deposit of lead oxide, which can easily be seen in the form of a gray powder coming off in clouds when it is brushed. If one considers all these sources of possible contamination of the air by lead in the form of metallic dust, or still worse, oxide dust, it is easy to see that lead poisoning may still be a danger in linotype work even if there be no fumes from the molten metal in the pot.

In addition to the danger of lead poisoning the operator is exposed in many instances to the effects of carbon monoxide from the gas burners under the melting pots. The presence of even small quantities of this poisonous gas in the air of working places, such as tailor shops especially, has been recognized as causing a gradual deterioration of health in those long exposed to it. (See pp. 33, 34.)

To summarize briefly, the symptoms of slow, chronic, carbon monoxide poisoning consist in anemia and in subjective symptoms such as headache, feeling of lassitude or languor, slowing of mental powers, breathlessness on exertion, sleepiness while at work, and obstinate insomnia. That it is the gas which causes these symptoms is readily seen by disappearance of the headache when in the open air and by the rapid improvement experienced by the men when proper measures are installed for carrying off the fumes from the burners. For instance, in a Chicago newspaper composing room there are 30 machines. The building is low and the window ventilation not very extensive, but the air is excellent because over each machine is a pipe with a strong updraft caused by a fan in the chimney to which the pipes run. The foreman in this room said that the men had felt at once an improvement in their health and in their capacity for work when this system was installed and that each time the fan had got out of order they had begun to complain of bad air within an hour's time. Now the effects of lead fumes, in the quantity that could be given off from small linotype pots, would come on very slowly and would not be perceived by the men for weeks, or more probably months, and the relief from such fumes after the installation of an exhaust system could not possibly be felt with such promptness and certainty as was true in this case and as was true in several other

instances related to the author. What the linotype operator is conscious of is the effect of the gas from the burner, not of lead fumes.

Hahn,[1] who refuses to believe that there are fumes of lead from linotype pots, still insists that the gases from the heating apparatus must be carried off and therefore that these machines must always be furnished with pipes and an exhaust. Roth[2] also speaks of the danger of poisonous gases from heating the lead with illuminating gas, as do Legge and Goadby.

It follows, then, that all machines should be provided with an exhaust system to carry off these gas fumes, for they are a menace to the health of the operator.[3] This has been demanded by the men themselves in many instances, but not as often as one would expect. Many a composing room is devoid of any protection of this kind, though every operator in it is a member of the union. Apparently the health committees of the different locals vary a good deal in their activity in this respect. St. Louis is the only one of the seven cities visited where at the time of this investigation all the linotypes were provided with pipes to carry off the gas.

A great variety of devices for this purpose may be found in the different plants, but the one essential feature is an adequate draft in the pipes. If the draft is strong enough nothing else is of much importance, and if it is not, the system is a failure no matter how elaborate it is. When there is a chimney with a good updraft and which can be reached without the pipes traveling too long a distance or making too many turns, an exhaust fan may sometimes not be necessary, but as a usual thing the suction is not strong enough unless a fan is installed.

A very poor system may be seen in some newspaper plants, notably in a large one in Chicago. The pipes lead up from the pots for a distance of 6 or 8 feet and then end free, and the fumes are expected to pass on up to the ceiling and out through ventilators in the roof, but these openings are not directly over the pipes and there is no artificial draft. When this particular plant was visited at 10 o'clock at night, for it publishes a morning paper, the air was already oppressive and the odor of gas quite perceptible. Though it was a warm spring night all the windows were closed and the forty-odd linotypists were working in an atmosphere which must necessarily have had a dulling influence on their mental powers, to say nothing of the sense of discomfort.

A large newspaper composing room in Baltimore has 31 machines and 2 monotype casters, none of them with pipes to carry off fumes.

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[1] Hahn, M.: Die Gesundheitsverhältnesse im polygraphischen Gewerbe Deutschlands, mit besonderer Berücksichtigung der Bleivergiftung. Bericht an die Internationale Vereinigung für gesetzliche Arbeiterschutz. 1908.

[2] Ueber Bleistaub und Bleidämpfe. Zurich, 1905.

[3] In newspaper offices gas may burn under the linotype machines for the whole 24 hours.

This room has windows along one end and one side, and in addition a large pipe with openings at intervals has been placed below the ceiling along the far side of the room and in this is a fan with a good suction. Nevertheless, this is not enough to carry off the gas fumes, and it is quite easy to perceive the odor of gas even on the side near the windows. In other respects this composing room is good.

In smaller shops where there are only two or three machines these are sometimes placed close to the windows for the sake of better ventilation, but in cold weather the men will almost always keep the windows shut and therefore window ventilation can never be looked on as entirely solving the problem.

The ideal linotype room is ventilated by means of individual pipes running from each pot to larger pipes in which there is an adequate exhaust created by a strong fan. In one of the Chicago evening newspaper plants the composing room at 3 o'clock in the afternoon, after seven hours of work, was found to be perfectly fresh and free from odor of any kind, yet the room is low and the window space far from ample. The ventilation is provided by an excellent system of piping. The pipes from the pots run up a distance of about 10 feet from the floor and each one ends just under a flaring hood which connects with the main pipe along the ceiling, and in this pipe there is a strong exhaust. These wide openings serve not only to draw up the gas from the machines but also to ventilate the whole room.

About 10 years ago one of the largest newspaper offices in New York introduced electrically heated linotype pots in the effort to do away with the objectionable features of the gas-heated machines. The first system installed was unsatisfactory and was rejected, but the second proved successful both from the financial and from the sanitary view. There are 57 machines in this plant, all with pots heated by means of an electric heating unit which is not applied to the outside, but is introduced into the pot. This system not only does away with the escape of gas fumes and renders piping unnecessary, but it also does away with a great deal of heat in the composing room.

At the time of this investigation three other large printing shops were experimenting with electricity in linotype casting. The largest book and job shop in Washington had installed a few electrically heated machines, and so had a newspaper in St. Louis and a book, job, and newspaper house in Boston. From the sanitarian's point of view these are a great improvement over the gas heated machines, and their adoption should spread rapidly.

We have spoken of the danger of lead dust in cleaning the machines and especially the plungers. When the care of only one linotype machine is involved, the risk is slight; but when there are many,

the man who has this work in charge runs a decided risk, a risk which is sometimes recognized by machinists but perhaps more often ignored or dismissed with contempt.

Such work is very commonly given over to the machinist's helper, who may be a boy. He may have to clean plungers every day or only once a week. There is the greatest difference in this respect in the different shops, some cleaning very often, others less than once a week. Those who use automatic feeders for the pots say that very little plunger cleaning is necessary, for the lead in the pot is kept at the same level all the time, and the dross on the surface does not sink down to the level of the plunger, as it often does when the operator has to do the feeding and delays too long. It is the coming in contact with the dross that clogs the plunger and necessitates frequent cleaning. In one of the Chicago newspaper plants plungers are cleaned each day, 12 of them in a half hour, while in another in the same city cleaning is done only once a week.

The usual method is to take the plunger out and, without letting it cool off, for that would mean that time would be lost in heating it again, to brush it off briskly with a wire brush. When this is done a very distinct cloud of gray dust comes off, and this is a finely divided suboxide of lead, which is easily breathed in and is one of the most dangerous of the lead compounds. In one of the large New York newspapers a machinist's helper was seen who had to clean no less than 70 plungers three times a week. He took them out on the landing of the stairway and brushed them with a wire brush, and he had been doing it for six months past. He complained bitterly of the effect of the work on his health, saying that he had been perfectly well before, but that of late he had had indigestion with loss of appetite and pain. He suffered from dizziness and had lost weight and everything seemed an effort too great for his strength. Certainly one would regard this as a case of lead poisoning, especially as there was a bluish-black line perceptible on the margin of his gums along the lower teeth.

Machinists who recognize the danger of this work use various devices to do away with the oxide dust. One man, in a St. Louis newspaper plant, demonstrated his method of using water, which most machinists insist is impossible. He took out the plunger and dipped it quickly for a moment into a pail of water, whereupon the oxide could be distinctly seen spreading out on the surface of the water in a gray cloud. The contact with the water was momentary only, not long enough to chill the plunger, and when it was then brushed with a wire brush there was practically no dust at all. To show the contrast, the machinist brushed another plunger without dipping it in water, and then the cloud of gray dust was very easy to see. This method was found in use only in this shop and in one

department of the composing room of a Chicago newspaper. Curiously enough, in the other department the machinists insisted that water could not be used without the risk of causing an explosion when the plunger was returned to the lead, though it was being successfully done in the other department of that very plant. Of course if the plunger were left long enough in the water to chill it, some drops might cling to it and explode in the hot lead, but if it is only dipped in for a moment the heat will be sufficient to dry it off completely, and there can be no doubt that this method does away with the dust.

More usual is the use of a light machine oil or of lard in very small quantities to keep down the dust. Here, too, there is a wide difference of opinion, many machinists insisting that all the oil can do is to "clog" the oxide and make it impossible to clean the plunger, while the men who use it find no difficulty at all. The very safest way to clean plungers is in a closed box worked from the outside. Such mechanical cleaners are obtainable from printers' supply houses and are said to be saving of labor as well as sanitary.[1] Certainly they do prevent dust. They were found to be in use in several eastern shops, but apparently had not been introduced to any extent in the western cities.

Linotype metal is usually softer than other type metal. Dr. Phelps found that that used in the Government Printing Office contains lead, 84.3 per cent; antimony, 9.5 per cent; and tin, 4.4 per cent.

MONOTYPE CASTING.

The monotype machine has the keyboard quite separate from the caster; indeed, the two kinds of work are not usually done in the same room. Perforated strips of paper are produced by the keyboard machine and these are fed into the caster and serve as molds for casting the type. The first need not be considered, since it is essentially no more than a typewriter, but monotype casting is generally regarded as fairly hazardous work. The temperature of the melting pot of a monotype casting machine is always decidedly higher than of a linotype pot, running from 500° F. in one Baltimore newspaper up to 850° F., which was stated to be the temperature in a St. Louis job shop. The difference depends largely on the different alloys used. In one place where there were three casters one was kept at 700° F., the second at 750° F., and the third at 820° F. Usually it is kept at some point between 700° and 780° F. There is very little agitation of the metal in the monotype pots and it is unlikely that lead oxide is given off except in skimming dross.

[1] The Ewald linotype plunger cleaner is one which the author has seen in successful use.

Gas is almost always used for heating, and all that has been said in the section on linotype work with reference to the evils of gas fumes and the necessity of carrying them away by a hood and exhaust system applies also to monotype casting machines. The best devices for this purpose were found in the largest book and job printing shop in Washington and in the largest one in St. Louis, in both of which hoods have been very skillfully fitted to catch possible fumes from the pots as well as from the gas jets. As a rule, however, the better plants only attempt to do away with the gas fumes by means of pipes running up from that part of the caster and ending under the flaring opening of an exhaust pipe which connects with a large pipe running to the outer air. Less well equipped shops have either no pipes at all over the gas jets or simply short ones which end free about 6 or 7 feet from the floor.

As is true of the linotype machines, lead scrap is constantly falling from monotype casters onto the floor and must be swept up and remelted. However, as a usual thing the casting is carried on in a separate room and whatever the risks they are confined to the few men who do the actual work. As a rule also the room is well placed, along the outer wall with plenty of window space. It is really the exception to find a dark, ill-ventilated, ill-kept monotype casting room. Such a room may be seen in one of the Washington newspaper plants, where the room devoted to casting is right in the center of the building with no ventilation, either natural or artificial, no pipes over the gas, and quantities of lead scrap on the floor, but this was the only quite neglected casting room seen. On the other hand, there are several places where casting is carried on in the composing room—a poor arrangement, because it adds an unnecessary danger to this department. One large job shop in St. Louis has seven casters in the composing room, but has taken precautions against possible trouble by well constructed hoods, and in addition the room is large and very well ventilated. Instead of carrying the pipes over the casters to the outer air another St. Louis shop has had the pipes end close to a window where there is a good suction fan.

On the whole this department is better planned and managed than any other in job printing and newspaper work, and in some instances, such as the largest book and job shop in Washington, the casting room with its machines is quite above criticism except for the fact that dry sweeping of the lead scrap goes on during working hours.

As is true of linotype metal pots, the substitution of electric heating for gas heating of monotype casting pots marks a great improvement, for it means that gas fumes are abolished and that there is much less heat given off from the pots. This method was, however, found in only one shop, the newspaper plant in New York which first

introduced the system of electrically heated linotype metal pots. This shop has used electricity to heat the monotype lead for almost a year on its nine casters and testifies to the entire practicability and economy of the method.

STEREOTYPING.

The evils to be avoided in stereotyping are: The fumes which arise when old plates are being melted down or "burned off," as it is usually called, and which come from the ink and contain acrolein (see p. 32); the lead oxide which, as Dr. Phelps's experiments (pp. 24 to 26) show, may be given off if the temperature is high and the metal is agitated; the dust caused by trimming and routing the plates; the heat from the kettles.

The work of stereotyping is as a rule badly housed and imperfectly safeguarded. The usual habit of placing the foundry in the basement does not always work out badly, for there are some basement foundries so well ventilated by good drafts of air down shafts and by suction fans in windows or air shafts that conditions in them are actually better than in others situated above the ground. Such a foundry was seen in a New York newspaper building which is situated in a very crowded part of the city and has little window space. Another was seen in Chicago. On the other hand, there is a stereotype foundry in the basement of a St. Louis building which not only has no direct connection with the outer air, but depends on the air sucked in from the pressroom by a fan which is placed in the opposite wall of the foundry, this wall separating it not from the outer air, but from the engineer's room. The hood over the kettle in this foundry, as in most foundries, is 18 inches or more above the edge of the kettle. No melting down was in progress at the time this place was visited, but it is easy to picture the state of the air when the fumes of acrolein from the ink on old plates begin to roll out from under the hood.

Still worse is the condition in a foundry in Chicago, for this one is in one corner of the basement pressroom, so that the heat from the three kettles and the smoke—very plainly visible when the visit was made—are spread over the pressroom and not confined to the foundry. A St. Louis plant also has placed its stereotype kettles in the pressroom, but they stand along the outer wall and a good fan in this wall serves to draw the fumes and heat away from the pressroom. The air in this place was excellent.

Occasionally it is not the stereotyping which adds unnecessary dangers to other less dangerous work, but vice versa; as, for instance, in a Chicago foundry, where a cupel furnace for refining dross has been placed. Lead must be heated to a far higher temperature in

these drossing kettles than in the ones for stereotype metal, and the lead usually runs out hot enough to give off visible fumes of oxide. In the largest printing plant in Washington the work of stereotyping is made not only unnecessarily disagreeable but hazardous by the proximity of the room for remelting and mixing metals, which is situated just beside the foundry. Many thousand pounds of used type are melted down here every day, with the evolution of such thick clouds of acrolein as sometimes to overcome the stereotypers working nearest to the door.

The lead in stereotype kettles is usually kept at about 700° to 750° F., but it may be as low as 600° or as high as 800° F. In five places this last temperature was found, and the statement was made several times by foremen that the heat might run up pretty high, "even to fuming point, if it is not watched." Since this lead is being continually agitated by ladling or pumping or by skimming off dross, it follows that there should be an exhaust system to carry off the fumes. This is generally recognized as necessary for the dense smoke which rises when ink-covered plates are melted down, even if the men do not realize the necessity for also carrying off the less perceptible but dangerous lead oxide dust.

The majority of stereotype kettles are protected by some form of hood. Sometimes this really incloses the top, but in that case there must be a fairly wide door for feeding and for ladling out the metal, and naturally this is left wide open, except, perhaps, when the smoke is bad at the beginning of melting down. When the new autoplate attachments have been put on, the hood can not come down within 1½ or 2 feet of the edge of the kettle, for the apparatus prevents it, so there is in this case a wide area for the escape of fumes. There was not one kettle found in the course of this investigation from which fumes could not be seen to escape, provided the surface of the lead was well stirred up. Therefore it may be true, as some foremen claim, that it is better to discard the hood altogether and depend instead on a strong suction fan in the wall as near as possible to the pot. In the best newspaper building in Boston this has been done, and it is said that the room is in consequence cooler and the air better, for the hood caught and held the heat. Two other newspaper plants in Boston have fans instead of hoods, and so have two in Philadelphia, but in one of the latter the fan is far too small to be effective.

Another Philadelphia foundry is unusually good and extremely clean and free from lead dust. The pipes are covered with asbestos, and both kettles have hoods, with a strong draft. In contrast with this is a very hot room in the same city, with an uncovered pot in the center, fuming, a linotype pot with a hood 2½ feet from the edge,

from which a man was ladling lead into the molds, and quantities of lead scrap everywhere.

In addition to lead oxide from the molten metal, another source of air contamination in these foundries is the lead dust. Routing machines are very often placed here, and even if they are in another room the scrap from routing is gathered up and dumped on the floor near the stereotype pot to be remelted. Then there are the shavings and scraps from the trimming and shaving of the plates, and there are the dross skimmings which it is almost an invariable rule to throw on the floor and then gather up again for the drossing kettle. Sometimes, as was the case in a Chicago newspaper plant, every bit of the floor of the foundry is thick with lead dust, and it is swept up and thrown about as carelessly as if it were sand.

The discomfort of work is increased for the stereotypers when the steam tables for matrices are placed here or when electrotyping, with its black lead and blasts of steam, is carried on in the same room.

In the course of the inquiry among printers, made by the Illinois Commission on Occupational Diseases (in 1910), 21 men were found who had suffered from well-defined lead poisoning. They were distributed as follows:

Stereotypers, 8; electrotypers, 5; linotypists, 2; compositors, 2; routing, etc., 1; machinist's helper, 1; all kinds of work, 2.

The stereotypers head the list, and yet they are not as numerous as the compositors in Chicago. Another proof of the greater hazard of this sort of work when compared with other branches of printing was brought to light by one of the investigators, Dr. Emery R. Hayhurst, now of the Ohio State Board of Health. He examined 57 linotypists and found 2 of them probably "leaded," which would represent a proportion of 3.5 per cent, while of 79 stereotypers whom he examined, 6, or 7.6 per cent, showed evidence of plumbism. These men had all worked more than 10 years, and 2 had slight palsy of the wrists, a symptom of slow poisoning.

ELECTROTYPING.

In electrotyping, a wax mold (usually not of beeswax but of ozocerite, a waxlike mineral) is made from a page of composed type or an engraved plate. This is then covered with black lead (graphite), either dry or suspended in liquid, in order to render the wax conductive to electricity, and is suspended in a bath of sulphate of copper through which passes an electric current which causes the deposit on this wax mold of a thin coating of copper. The wax is removed and the copper shell is mounted on a lead back.

The important features in this work are the pot in which the lead is heated, the hot pans on which the process of backing is carried

out, the trimming and routing of the plate and, in some instances, the use of wood alcohol to clean the plates and favor the deposit of the copper.

The lead for the backing of plates is melted in an open pot and poured out on heated metal pans. Since it is a simple thing to cool the lead down to just the right temperature in these pans, it does not matter if the lead in the pot is allowed to run up to a fairly high temperature. Usually about 650° to 700° F. is the point aimed at, but foremen admit that it is not closely watched, that 850° F. is not unusual and that it may even go up to "fuming point."

The copper shell is washed off with soldering fluid, then covered on the reverse side with thin lead foil, laid face down on the surface of the lead on the backing pan, the heat of which melts the foil, the plate is removed to a cooling table and a ladle of molten lead poured over it to back it. It is cooled, sawed or shaved to the proper height, hammered to the right level, the edges are beveled and the superfluous metal removed by routing. A routing machine has a tiny chisel which cuts away the lead from the parts of the plate where it is not wanted, sending the fragments flying far and wide. The chisel is grooved in such a way as to give the lead chips a downward direction on the whole, so that they are not likely to fly into the operator's eyes. The possibility of this is however great enough to make the use of goggles very desirable.

There are two chief dangers in an electrotype foundry—lead dust and lead oxide from the pot and the backing tables. As is true of all such work in printing, old electrotype plates are remelted and the metal used a second time, and when these ink-covered plates are melted down there is the same evolution of acrolein fumes as is found in linotype melting pots and stereotype pots. The same question also arises as to the presence of lead from these pots. According to Dr. Phelps's experiments it seems plain that when the temperature reaches 450° to 520° C. (842° to 968° F.) and the lead is stirred or skimmed or ladled, or new lead is added, there is an evolution of oxide which rises into the air immediately surrounding the pot. This means that some method should always be adopted to carry off fumes, either by installing a hood with a strong updraft or placing a fan in the outer wall close to the kettle. As a usual thing there is no hood over the pot, and when there is, it is rarely adequate to serve its purpose. Often it is adjustable and is lowered only when the metal is being melted down, to prevent the escape of the disagreeable smoke, but is raised again just at the time when the danger from lead begins. If the hood is stationary, it is likely to be placed too high to be of much use, especially when the vent is narrow and the air exhaust weak. In a Philadelphia foundry

the pot is right in the middle of the room and there is a small hood in the ceiling, with no artificial exhaust. In this place both pot and backing table were giving off visible fumes of oxide at the time the investigation was made.

This danger, not only from the pot but also from the backing table, is recognized in all the better-class plants. The superintendent of an excellent foundry said that the men often let the backing pans get hot enough to give off fumes. A large book and job printing plant in Cambridge has a very good foundry, clean and airy, and the pot and backing table are placed in a corner of the room near the windows, with a window in the ceiling also. The hood is 4 feet above the edge of the pot, so that work is not interfered with, and the suction is very strong. The largest foundry in Philadelphia has placed hoods over both backing table and pot. The hood for the latter is adjustable and is lowered during melting down.

Even without a hood much can be done with fans to carry off fumes from a foundry. In the electrotype department of one of the Philadelphia newspapers is a ventilator with a good fan in the ceiling directly over pot and table. In the largest job house in St. Louis the foundry is low ceiled and old fashioned in many ways, but it is well aired by a skylight opening just over the pot, the natural draft being apparently strong enough to work very well, though doubtless there are times when smoke and fumes are driven down instead of being carried up. The largest printing establishment in Washington depends entirely on window and fan ventilation, but it is not successful. The unhooded pans and pot stand near the window and there is a fan in the wall, but at the time the inspection was made it was easy to see the bluish fumes of lead oxide rising from the molten surfaces, and only part was sucked out by the fan; the rest blew into the room because the wind was in that direction. There are 130 men employed in this foundry.

In addition to the fumes there is more or less lead scrap in an electrotype foundry, sometimes large quantities. This collects around the routing machines, even when they are inclosed in walls of wire net. The smaller fragments make their way through the net, though one Chicago superintendent has doubled his netting with the result that very little lead escapes. There are also shavings from sawing and beveling the plates, and there is a good deal of lead splashed on the floor when the men are backing plates, and often dross also if it is not dropped into a special receptacle. All this scattering of lead is quite unnecessary. There are foundries, notably a model one in Chicago and a beautifully clean one in St. Louis, where no lead is permitted to fall on the floor and remain there, but these are exceptions; usually no care at all is taken. The large Washington foundry referred to above is surprisingly neglected in this respect. Two of

the routers are devoid of protecting nets and are surrounded by piles of scrap; there is great carelessness as regards splashing lead, and sweeping goes on continually during working hours.

Another source of lead fumes is the solder which is used to fasten together parts of plates which have had to be sawed apart to make corrections. This is ordinary solder used in the ordinary way with a gas flame. In very large foundries the sticks of solder are made on the premises by ladling the metal into molds. A certain amount of hand finishing may also be done in connection with electrotyping, such as scraping leads and "mortising," i. e., filing.

Black leading is dirty work. The black lead is very light and flies all over, darkening walls and ceilings, and settling on the windows. This may be one reason why electrotype foundries are so often dirty, neglected places. The effort to keep them clean is too great, apparently, and they are surrendered to the dirt that is looked upon as inevitable. Still there are in every one of the seven cities foundries which are a source of pride to their owners, where walls are painted white, and the graphite kept under cover, where floors are smooth and are kept clean, places really pleasant to work in. As a usual thing the heat is great enough to be very disagreeable, and in many places a blast of steam is used to clean plates, adding greatly to the discomfort of the workmen.

It was impossible to discover the extent to which wood alcohol is used in electrotyping, for questions on this point are not always answered frankly, but it may be taken for granted that its use is always attended with some risk, since the fumes of wood alcohol are notoriously dangerous, and there is also a possibility of absorbing it through the skin.

Dr. Hayhurst, of the Illinois commission, examined 12 electrotypers, and found 1 of them with signs of "leading." Among 21 cases of lead poisoning in the typographical trades in Chicago 5 were electrotypers. They had worked more than 10 years each, and 4 of the 5 had loss of power in the wrists.

THE PRESSROOM.

The work in the pressroom has many elements of discomfort, but has not the risk of lead poisoning. Pressrooms, like stereotype foundries, are often placed in basements, although, as in the case of the foundries, some of the basement pressrooms are better ventilated than are those built above the ground. The air in pressrooms is often heavy, and the excuse given for the lack of better ventilation is that a current of air would be bad for the ink, although apparently in other places the ink is not injured by currents of fresh air blowing in all the time. One objection to basement pressrooms is that all the work must be done by artificial light, and almost invariably this is provided by

glaring, unprotected electric bulbs, which make little islands of brilliant illumination surrounded by semidarkness.

Pressrooms are not usually scrupulously clean, but the dirt is of the most harmless kind—scraps of paper, chiefly—and the floor is usually oily enough to be almost dust free. Sweeping here has none of the undesirable features that it has in the composing room or in the foundry. The presence of lead dust and lead fumes is exceptional here, for though stereotyping is sometimes carried on in the pressroom, it is not commonly done. Of course, in small shops there is often only one room for all the work, and the pressmen are exposed to whatever dust and fumes are produced in all the processes.

Certain book and job houses have really model pressrooms, as, for instance, one in Cambridge, where the walls are covered with white enamel paint, the floor is of hardwood in perfect condition, the natural lighting is excellent, and artificial light provided for by clouded white globes. The ventilation is very good. Instances of equally good conditions were found in New York, in Philadelphia, and in Chicago. The worst pressrooms were in newspaper plants, where steam tables or foundry kettles added greatly to the discomfort of the men and in some cases were a source of air pollution from acrolein smoke and lead fumes. If the routing machines are in the pressroom, as is sometimes true, lead dust is scattered over the floor.

An important feature of work in the pressroom is the composition of the ink, and another is the method of cleaning ink off press rollers.

The essential constituents of printer's ink are linseed oil, varnish (resin and boiled linseed oil), and pigment. The linseed oil may be adulterated with cottonseed oil, fish oil, benzine, or turpentine. The varnish may have litharge (one of the oxides of lead) or lead nitrate or lead linoleate or manganese dioxide added as a drier.

Black is, of course, the most common pigment, and consists of carbon in a fine state of division obtained from burning oil or natural gas. The former is called lampblack, the latter carbon black. The next most common color is red, and this is always a coal-tar red. Yellow may be lead chromate or ocher or one of the cadmium colors, while green is often chrome yellow with an admixture of blue. For white, both zinc and lead whites are used and both have their advocates. This does not complete the list of colors used in printing, but the others are of no hygienic importance. The lead salts are the only ones that can be considered harmful, though certain of the coal-tar reds are capable of producing dermatitis in men with delicate skin.

Press rollers are made by boiling together glue and glycerin. They are cleaned in a great many different ways, but usually the solvent employed to soften the ink is one of the petroleum distillates, sometimes mixed with other solvents, sometimes used alone. "Coal oil," or kerosene, is common, so is benzine. Turpentine, an impure

variety of which seems to be in frequent use in Europe, is not found in pressrooms in this country.

The complaint made by men who have to use benzine is that the fumes are irritating, while the heavier distillates, kerosene or coal oil, cause acnelike eruptions on the hands and forearms in some cases. Much more serious, however, is the risk involved in handling roller washes which contain wood alcohol or anilin oil. In one pressroom the foreman said that he made up a mixture of glycerin and wood alcohol. Another gave as his formula anilin oil and oleic acid, one part each, to two parts of benzine. He admitted that the men disliked to use it unless all the windows were open.

There is a great variety of roller washes on the market, some of which are known to contain enough anilin oil to set up serious symptoms in men exposed to the fumes in ill-ventilated rooms. (See pp. 31, 32.) Benzol used to be a constituent of the stronger washes, but is said to be too expensive since the war. According to a maker of roller washes all the strong ones, those that "cut the ink," contain anilin oil or wood alcohol or both, except the noninflammable ones, which probably contain carbon tetrachloride (tetrachlormethane), a narcotic poison with an effect very like that of chloroform, only slower.

REFINING DROSS.

There is an increasing tendency, now that the price of lead has risen very decidedly, for newspaper plants and large job houses to recover the lead from dross skimmings instead of selling it to junk dealers. Sometimes the dross is simply remelted and a small part of the lead recovered, the oxide being sold, but in several plants a cupeling furnace has been installed for the actual reduction of the oxide. This introduces a quite new danger into the printing industry, for in such a department are carried on processes usually confined to lead refineries. The fumes which escape from a cupeling furnace during feeding and tapping are lead-laden beyond question, and the risk is greater because the work is not by any means always intrusted to an experienced man nor is the furnace placed so as not to contaminate the air of the rest of the shop. Even when dross is only remelted the furnace may be allowed to get red hot and fuming, as is the case in several plants in St. Louis, in one in Washington, and in one in New York.

It is very desirable to have this work done in a separate room and this has been provided for in three newspaper plants in Boston, in one in Chicago, and in one in New York. The Chicago house has by far the best arrangement, a small iron shed on the roof. The others have placed these furnaces in basements, in some of which the ventilation is very poor. The plant in Boston has its furnace in a tiny, un-

ventilated subbasement, with not even a window. Piles of dusty dross lie on the floor and the lead runs out into an open kettle from which it must be ladled into molds. The foreman admitted that he had much difficulty in getting men to do the work, as it "knocked them out in a few days."

One of the Chicago morning papers has placed the drossing furnace in the stereotype foundry, a procedure one would consider objectionable on the face of it, but in this case it works very well, because the furnace has been set up beside a narrow air shaft the opening of which is just on the level of the tapping door of the furnace. The suction up through this shaft is strong enough to carry up a large piece of paper and quite disposes of any fumes which rise when the hot lead runs out. This furnace raises the temperature of the lead to 1,200° F.

It is a pity that this work of lead refining should be introduced into the printing industry.

TYPE FOUNDING.

According to German, and even more to Austrian, factory inspection reports, the founding of type is carried on in connection with printing in those countries and the numbers of lead-poisoned operatives are always decidedly increased by the type founders and especially by their women helpers. (See pp. 80–82.) In the United States type founding is a separate business, carried on chiefly in three large establishments. There are, however, some book and job houses and a few newspaper offices that have small type-founding machines of their own in addition to the monotype and linotype machines. These are essentially the same as the ones in the large foundries, which will be described briefly.

Four foundries were visited in the course of this inquiry, but one of them was small and bought its metal already mixed. The others mixed their own alloys. The largest one has this work done in a separate room, large and fairly well ventilated, but with a badly broken cement floor which could not possibly be kept clean and which actually is covered with dross and scrap. The dross is shoveled into the kettle through a feed door which is not protected by a hood and the lead runs out into an uncovered pot. There is a great kettle for mixing metal, capable of holding 15,000 pounds at a time. This is covered, but the feed door on the top and the tapping door are both unprotected. The temperature of the lead is usually at about 800° F. Dross from this kettle is worked up in a small smelting furnace. The five men working here are exposed to much lead dust as well as fumes, but they have only cold water to wash with, no soap or towels, nor are they forbidden to eat their lunch in this room.

In the second establishment the metal mixing is carried on at the end of the foundry, one man being employed in mixing 3,000 to

5,500 pounds a day. There are two covered kettles, but the covers must be raised for feeding or skimming and also for ladling out the metal into molds. Dross is not worked up here; it is sold. Here, too, the only provision for washing is cold water.

In the third the mixing is done in the basement beside a window. The cement floor is new and clean, the place well ventilated, and both mixing pot and refining furnace are well hooded. The risks in this place consist in feeding the furnace with dross, which is always very dusty, and in the fumes which rise from the tapping doors of metal pot and refining furnace.

In the foundries two kinds of type casters are used, the old Bruce machines which cast type needing to be finished in various ways before it can be used, and the newer Barth machines, the type from which is already finished and ready for use. There were 75 Bruce machines in use in the largest foundry, 36 in the next largest, and 26 in the third, meaning that a great deal of hand finishing must be done in all these plants. The Bruce casters have open lead pots, from 4 to 8 inches in diameter, and the temperature is said to run from 600° to 850° F. They are heated by gas.

Barth casters have largely superseded the Bruce in the largest foundry. Here the lead pots are large, about 11 inches in diameter at the top, and the lead is kept at about 750° to 800° F. They, too, are heated by gas. In none of the foundries are there any hoods either over the molten lead or to carry off gas fumes, yet in one large room no less than 75 Bruce casters and 250 Barth casters were found. The evil of gas fumes is the same as in connection with linotype work and the risk of lead fumes is greater, for the lead is kept at a higher temperature.[1]

The feature always emphasized in foreign writings on the danger of work in a type foundry is not, however, lead fumes so much as lead dust from the hand finishing of type. The type cast by the Bruce machine must go through various processes, all of which are productive of dust. First the "jet" must be broken off. This is a little projection of lead at one end, produced in casting. Then the broken surface on the edges of the type must be smoothed by rubbing on a file—this may be done by machine or by hand—and the pieces of type must be "set up," placed in a row along a stick with another stick fastened at right angles to hold them preparatory to "dressing" or grooving out the foot. There is also a machine for "kerning," smoothing type to make certain letters fit more closely side by side. Finally there is inspecting, assorting, and packing.

By far the greater part of this work is done by women and girls. In one large foundry the filing and inspecting are done by men; the

[1] The formula for the type metal used in this place was stated as follows: Lead, 60 to 55 per cent; antimony, 25 per cent; tin, 10 to 15 per cent; copper, 5 per cent.

rest of the finishing employs some 200 women. In a smaller one all the finishing is done by 20 women, and in a third, 7 men, 2 boys, and 24 women are employed.

Finishing is dusty work, and the dust that is produced is apt to be inhaled by the workers, since it is fine work, requiring close attention, and the women sit bent over their benches with their heads close to their machines or tools. The fine, gray powder can be seen on the benches, and the women clean it off with soft brushes. They also use pads of plush to hold the type, and these get full of lead dust and are shaken and beaten clean from time to time. The finishing is often carried on in the room where the casting machines, with their gas fumes and possibly lead fumes also, are installed. In the largest foundry 75 Bruce machines stand in the finishing room, with the lead at 855° F. in some of them.

The only cases of lead poisoning among women in the typographical trades which were discovered by the Illinois Occupational Disease Commission were among workers in this department of a type foundry.[1] There were four, all employed in finishing type by hand, and they had been doing that sort of work for periods of from 3½ to 35 years. They, of course, represented less serious forms of lead poisoning, since they had been able to keep on working. There is a continually changing force of girls and women in this sort of work, the more susceptible quitting, the more resistant staying on.

Though type founding as such is a separate industry in this country, yet much that is done in printing shops is really type founding. Linotyping, monotyping, and stereotyping are all methods of casting and we can not say that American printing shops are free from the dangers connected with this branch, especially as the mixing of metal and the casting in molds are very commonly done in all but the smallest shops. The mixing department in the largest printing shop in Washington is very important. There are three large pots, with an output of 10,000 pounds a day each, and one small pot which mixes 1,800 pounds of linotype metal and 8,000 pounds of monotype metal. The pots are all hooded, but at least one-third of the circumference of the hood is open and the vent pipes are too small and the draft not strong enough. When melting down of ink-covered type is being done there are clouds of acrolein vapors which are almost more than the men can endure, and after this stage is over and the lead raised to its proper temperature, the bluish fumes of oxide can easily be seen escaping from each pot whenever the metal man stirs or ladles or skims the lead.

In the shops which have single type-casting machines these are for the most part placed in separate rooms and the type cast needs no further hand finishing.

[1] Page 44.

BOYS IN THE PRINTING TRADES.

The International Typographical Union has formulated certain definite rules as to apprenticeship, but leaves other features to be dealt with by the local unions. Thus the term of apprenticeship must be at least four years, but some cities increase this to five. The age at entrance is not specified and naturally follows more or less the child-labor laws in different parts of the country, being anywhere from 12 to 16 years. New York and Chicago insist on 16 as the minimum, and the course in each of these cities covers five years. The planning of the apprentices' training course is also left to the locals, as is the standard of competency which the boys must reach in order to be accepted as journeymen. The International Typographical Union maintains a correspondence school of its own and apprentices are encouraged to enter it. In 1915 there were said to be upward of 5,000 students enrolled. The Chicago local insists on a six months' course in the school for its apprentices.

Though the number of apprentices permitted is left to the locals, it is always strictly limited, and consequently there are in all shops numbers of boys who may not be old enough to enter as apprentices or who are waiting for a vacancy and meantime acting as floor boys or porters, and there are also boys who are simply doing the work as they would in any shop without the intention of eventually entering the industry. Nonunion and open shops may have as many boys as they please. There is a nonunion shop in Chicago which maintains its own training school and has 175 boys out of a total force of 420 employees.

There are no rules against intrusting to apprentices work which is hazardous because of lead fumes or lead dust as there are in many European countries, where it is recognized that young people are much more susceptible to lead poisoning than mature men. In Germany boys are not allowed to blow out type cases, in Norway they may not sweep the floors, in Denmark they are forbidden to work in the stereotype department. Both the Austrian royal report and Ducrot's report to the French Government advised that no young person be allowed to do any work which would bring him in contact with lead.

The boys in American printing shops are not protected at all from the dangers incidental to or inherent in the trade. Copyholders and errand boys may not, according to union ruling, set or distribute type or break up forms, but they often do the sweeping and tend the melting pot. Apprentices have their course more or less rigidly prescribed, but there is nothing to prevent their doing any sort of work in the composing room. Usually they are forbidden to work

overtime or more than six days a week, which is an excellent regulation. Apparently the union has not been impressed with the necessity for any further protection for future printers, since boys may be seen doing the more dangerous kinds of work in book and newspaper shops in all the seven cities visited.

In the course of this investigation boys from 14 to 18 years of age were actually found at work in the following occupations:

1. Sweeping around the linotypes in the composing room, and gathering up lead scrap, in one instance going down on hands and knees to brush the scrap from around the very complicated standards of the machines. This was seen in two Baltimore shops, in two newspaper composing rooms in Philadelphia, and in two in Chicago. In one of the last the boy was sorting over the swept-up scrap to pick out the leads and matrices.

2. Cleaning linotype machines by blowing and brushing, and cleaning linotype plungers with a metal brush. A 16-year-old boy was doing such work in a Philadelphia job shop. Boys were found employed at this very dusty work in a Chicago job shop and in three newspaper plants, one each in St. Louis, Chicago, and New York.

3. Gathering and dumping scrap, feeding it into melting pots, and casting "biscuits" for the linotypes. Sometimes the metal runs out into molds, sometimes it must be ladled out. In a very dirty, unventilated job shop in Boston (a union-label shop), with an almost incredible amount of lead dust on the floor and heaps of it around the pot, three boys under 18 years were sweeping and were tending the linotype melting pot. In a Philadelphia job shop the boy doing this sort of work did not look to be 16, and in another he was said to be only 15. A large Boston newspaper and book shop combined was employing a boy at this work, and so was a Washington job shop.

4. Blowing out dusty type cases. This recognizedly dangerous work is done by boys in a large nonunion shop in Chicago, in two Philadelphia job shops, and in one shop each in Baltimore, Cambridge, and Boston. This Boston shop handles much old type and it was said that the two boys, 16 and 17 years old, might have to blow out cases two or three times a week.

In an electrotype foundry there is usually one boy to five or six men, and the sweeping around routers and kettles is invariably assigned to them. On the other hand, in stereotyping one hardly ever sees boys, all the work, including the sweeping, being done by men.

Among the hundred men examined by Dr. Ellis (p. 91) were two youths who showed evidence of lead poisoning. One was a machinist's helper, who had worked only two months in a large job shop, cleaning linotype machines and plungers. He had the lead line along the gums, anemia, digestive disturbances, constipation, headache, and nervousness. The other was sawing and trimming castings. He also

had the lead line, anemia, headache, abdominal pain, attacks of dizziness, and constipation.

WOMEN IN THE PRINTING TRADES.

Women are accepted as members of the typographical union on exactly the same terms as men. They must go through the same apprenticeship, and after becoming journeymen they have the same hours and receive the same pay as men. They are found in large numbers as proof readers and are usually the operators on the monotype keyboards. In nonunion shops they are press feeders, sometimes doing all that work, and always there are large numbers employed in the bindery departments. As compositors and linotypists they are not numerous. In the course of this investigation, which took in only those processes involving exposure to lead or other poisons, only 14 women linotypists were found out of a total of about 1,532 operators, and only 103 hand compositors out of a total of about 3,800. These 117 women were, for the most part, in nonunion or open shops—49 were found in one large nonunion shop in Chicago, 37 in nine open shops (seven of them in Boston and Cambridge), and 31 in eight union shops.

As is true of women's work in all trades, there is a wide difference of opinion as to whether it should be permitted in the printing trade. This difference was brought out clearly at the meeting of the International Association for Labor Legislation in Lugano in 1910 and at the following meeting in Zurich in 1912. The Italians, under Carozzi, took the stand that for the good of the race women must be forbidden to work in this industry, since the danger of lead poisoning is too great and not only are women more susceptible to this form of poisoning, but the results are transmitted to their offspring. The Austrians also were in favor of forbidding women to work at any occupation in printing which involved contact with lead, and the regulations now in force in Austria contain this provision. Carozzi has since reiterated most emphatically his conviction that this trade must be closed to women, though he admits that he has no proof of injury to those employed in Italy, since their number is too small to warrant any conclusions.

The British, on the other hand, maintained that it was entirely possible to do away with the danger of lead poisoning in the printing trade and that efforts should be directed toward that rather than toward the shutting out of women from an industry in which they had long been employed and which was in many ways suited to their powers. The French and the American delegates stood with the British.

The typographical industry is not the only one in which efforts have been made to prohibit work by women on the ground of danger

to health, but whenever, as is certainly true in printing, the dangers are all avoidable the only logical and fair thing to do is to abolish these dangers. The Austrian statistics of lead poisoning in women, on which so much stress has been laid, depend on the fact that women were employed in hand finishing of type, work which is dangerous for men also and which should be replaced by mechanical means. (See p. 55.) Whatever process in printing is dangerous for women has dangers for men also, and, as we have repeatedly shown, all these dangers can and should be prevented.

In the United States women are, of course, freely admitted to the trade, and while some foremen believe that the work is not well adapted to feminine strength and endurance others say that women hold out quite as well as men on the machines and that there is nothing in the work of the composing room that is beyond their strength. All agree that women make excellent proof readers, and in union shops proof readers must be practical printers, as must also the keyboard operators for the monotype machines. The occupations entered upon by women are largely those which do not expose them to lead poisoning or to other special dangers.

HEALTH OF PRINTERS.

There is a general impression in all European countries that printing is among the more unhealthful industries and that printers have disproportionately high sickness and death rates. The same impression has prevailed in this country. In Europe the statement is very generally made that part of the undue amount of sickness among printers is to be attributed to the fact that the industry is recruited from the less robust, less sturdily developed boys who reach working age, that the work attracts especially those who are not able to stand a great deal of muscular exertion. This is not usually held to be true of the printing trade in the United States. (See p. 98.)

Since printing is an old industry, always employing men who are decidedly above the average of wage earners in intelligence and influence, it has attracted the attention of sanitarians in all countries, and it is possible to gain much information from the literature of industrial hygiene and from the reports of factory inspectors concerning conditions in the printing trade and the sickness and death rates among printers in Great Britain, Germany, Austria, Italy, and Holland. Some of this material, however, relates to conditions in former years, since which time marked improvement in working conditions and in mortality rates may have been made, as in the printing industry in the United States. This should be borne in mind in considering the figures for European countries.

ENGLAND AND WALES.

The mortality statistics for England and Wales show that for each age group up to 35 years the death rate from all causes is decidedly higher for printers than for all occupied males, the excess being from 0.45 to 1.62 per 1,000. For ages 35 and over the proportionate difference in rates is small.

In the table following the mortality from all causes among printers is compared with that of all occupied males for the years 1900 to 1902. Figures for a more recent period are not yet available.

TABLE 2.—MORTALITY FROM ALL CAUSES AMONG PRINTERS, COMPARED WITH THAT OF ALL OCCUPIED MALES IN ENGLAND AND WALES, 1900 TO 1902, BY AGE GROUPS.

[Source: The Mortality from Consumption in Dusty Trades, by Frederick L. Hoffman, in Bulletin No. 79, U. S. Bureau of Labor. Compiled from data in Supplement to Sixty-fifth Annual Report of Registrar General of Births, Deaths, and Marriages in England and Wales, Part II, London, 1908.]

Age at death.	Death rate per 1,000 for all occupied males.	Death rate for printers.		
		Rate per 1,000.	Greater (+) or less (−) than rate for all occupied males.	Ratio to rate for all occupied males.
15 to 19 years	2.44	3.19	+0.75	131
20 to 24 years	4.41	6.03	+1.62	137
25 to 34 years	6.01	6.46	+ .45	107
35 to 44 years	10.22	10.19	− .03	100
45 to 54 years	17.73	17.76	+ .03	100
55 to 64 years	31.01	30.76	− .75	99
65 years and over	88.39	87.61	− .78	99

HOLLAND.

An inquiry into the printing trade in the Netherlands was made in 1908 by De Vooys.[1] He compares the death rate of printers with that of men in certain other trades, selecting painters because they also are exposed to lead, indeed to a much greater extent than are the printers; shoemakers, because they work in closed rooms and are often not naturally robust; and carpenters and gardeners because they represent unusually healthful trades. De Vooys shows that in Holland a very large percentage of the printers are found massed in the early age groups. Almost one-half, 46.43 per cent, are under 23 years of age, while shoemakers have only 29.21 per cent in that age group, painters 30.63 per cent, carpenters 29.85 per cent, and gardeners 25.23 per cent. This points to something abnormal in the printing industry as does also the fact that there is a larger number between the ages of 12 and 17 years (26.71 per cent) than between the ages of 18 and 22 years (19.72 per cent).

De Vooys found an excessive death rate among printers compared with occupied males generally for all the age groups up to 35 years. As shown by the table following, it is most striking in the group 18 to 22. The figures, it should be noted, are for the period 1896 to 1900.

[1] De Vooys, P.: Bericht der Niederländ. Sektion der Internationalen Vereinigung für gesetzliche Arbeiterschutz, 1908.

TABLE 3.—DEATH RATE PER 1,000 FROM ALL CAUSES AMONG PRINTERS, AMONG MEN OF FOUR OTHER SELECTED TRADES, AND AMONG ALL OCCUPIED MALES, BY AGE GROUPS, 1896 TO 1900.

[Source: De Vooys, Bericht über Bleivergiftung in den polygraphischen Gewerben in den Niederlanden, 1908, p. 8.]

Occupation.	12 to 17 years.	18 to 22 years.	23 to 35 years.	36 to 50 years.	51 to 60 years.	61 to 65 years.	66 to 70 years.	71 years and over.
Printers	2.15	8.78	6.90	7.37	15.38	20.53	47.17	94.59
Shoemakers	2.19	7.02	6.47	9.00	16.72	34.93	53.37	110.31
Painters	1.54	6.45	6.19	9.29	18.59	35.15	59.61	101.00
Carpenters	2.06	4.67	6.10	7.84	18.18	30.42	46.41	100.42
Gardeners	1.77	3.16	3.86	5.70	11.66	20.99	34.09	76.79
All occupied males	1.85	4.84	5.24	8.23	17.56	28.97	47.39	96.24

FRANCE.

In regard to the mortality rates among French printers no recent figures are available. In 1880 Guignard[1] wrote a report of the printing trade in France, declaring it to be a very unhealthful occupation. He was especially impressed with the evils of excessive speeding up and of nightwork. The death rate of Paris printers was decidedly above the average for all men of the same ages, and these deaths occurred especially in early life. In 1879, out of 65 printers dying in that year, 14 were between 20 and 30 years old and 22 between 30 and 40. The average death rate per 1,000 for printers between 1876 and 1879 was no less than 24.7, while it was only 15.7 for all Parisian men between 25 and 65 years of age.

Bertillon, at the International Congress of Hygiene and Demography held in London in 1891, gave the statistics for Parisian printers during the five years from 1885 to 1889. The deaths are grouped by ages, and in all the age groups the printers have a higher rate than that for the general male population of the same age. If we select for comparison the trades chosen by De Vooys, we shall have the following table:

TABLE 4.—ANNUAL MORTALITY RATES OF PRINTERS, OF MEN OF FOUR OTHER SELECTED TRADES, AND OF ALL MALES, IN PARIS, BY AGE GROUPS, 1885 TO 1889.

[Source: Report of Seventh International Congress of Hygiene and Demography. London, 1891, Vol. X, pp. 54, 55.]

Occupation.	Death rate per 1,000.			
	20 to 29 years.	30 to 39 years.	40 to 49 years.	50 to 59 years.
Printers	17.8	23.7	26.7	40.6
Shoemakers	13.4	19.2	20.4	35.3
Painters	14.8	23.0	28.8	42.0
Carpenters	10.5	18.8	24.3	30.7
Gardeners	11.1	13.6	21.6	(2)
All males	11.1	14.9	21.2	31.0

[1] Guignard, in Journal d'Hygiène. Paris, 1880, vol. 5, p. 184.
[2] Not reported.

Bertillon was obliged to include among the printers, engravers and lithographers, but not bookbinders. A comparison between his table and that of De Vooys shows that in France also the mortality for printers is high, but not as high as in Holland, nor is there the same excessive rate in the early age groups among the French printers as among the Dutch.

AUSTRIA.

The Austrian Government ordered an inquiry into health conditions in the printing trade, the report of which was published in 1909.[1] The investigators declared that among the trades which expose workers to constant danger from lead poisoning, the typographical trades take a conspicuous place. The dangers in this industry are lead dust, irritation of the skin from using benzine or turpentine in cleaning type, flat foot from constant standing, eyestrain, bad posture, air vitiated by gas and overcrowding, great heat especially for stereotypers, and the fact that the trade attracts the less robust youths.

ITALY.

Carozzi's study of this trade in Italy[2] was published in 1912 as a contribution of the Italian section of the International Association for Labor Legislation. Carozzi believes that printing is an unusually unhealthful industry, with sickness and death rates decidedly above the average, especially from respiratory and digestive diseases. The statistics he gives are for Milan for the 10 years between 1900 and 1909.

TABLE 5.—NUMBER AND PER CENT OF DEATHS IN EACH AGE GROUP AMONG PRINTERS OF MILAN, 1900 TO 1909.

[Source: Publication of International Association for Labor Legislation. Italian section, new series, No. 4, Pt. II, p. 36.]

Age group.	Deaths in each age group.	
	Number.	Per cent.
Under 15 years	22	3.6
16 to 25 years	180	30.3
26 to 35 years	99	16.7
36 to 50 years	112	18.8
51 to 60 years	75	12.6
61 to 70 years	69	11.6
Over 70 years	38	6.4
Total	595	100.0

[1] Bleivergiftungen in hüttenmännischen und gewerblichen Betrieben, in k. k. Arbeitsstatistischer Amt im Handelsministerium. Vienna, 1909, Vol. VII.

[2] Inchiesta igienico-sanitaria nell' industria poligrafica in Italia. Pubblicazione della Sezione Ital. dell' Associazione internaz. per la protezione legale dei lavoratori. 1912. Parte II.

Evidently many young persons are employed, since a strikingly large proportion of deaths were in early life, no less than one-third of the deaths occurring under 26 years of age. In contrast with these figures it may be noted that in the United States in the International Typographical Union in 1913 to 1915 only 3.3 per cent of the deaths were under 25 years of age, 16 per cent under 35 years, and 38.9 per cent under 45 years.

Carozzi followed for two years the histories of 600 Italian printers and found, as almost all students of this industry have found, an abnormally high morbidity rate, caused in part, he believes, by the admission of large numbers of comparatively weakly individuals who are incapable of undertaking heavy work and are under the mistaken impression that this is an easy occupation which makes little demand on the strength. He says it is a matter of everyday observation that printers are less robust than the average workingman, and therefore it is easy to understand why they succumb to the effects of handling lead, holding type in the mouth, failing to wash their hands before eating, and standing on the feet for long hours. The nervous strain of the work also is very great, especially in nightwork and in newspaper offices, and this results in a high proportion of functional nervous diseases, irritability, heightened reflexes, insomnia, and tremors. The high morbidity rate is caused chiefly by digestive troubles, second by respiratory diseases. Disturbances of metabolism and neurasthenia are common.

GERMANY.

Several valuable studies of the printing trade in Germany have been published. All the earlier authorities on industrial diseases in Germany and a few of the later ones maintain that printing is a decidedly dangerous trade. Aside from the fact, which is always emphasized, that this industry attracts poorly developed apprentices, various other causes are given for its unhealthfulness. Silberstein[1] explains the high death rate among printers on the following grounds: First and most important is dust, because in a printing shop the dust may contain lead. In addition, it is an occupation that requires continual standing and this means poor circulation, chilliness, unwillingness to have the windows open. In many parts of the printing shop the temperature is always too high, and heat makes the man oversensitive to exposure. Pannwitz[2] made an exhaustive study of this industry, and as a result of his report on conditions in the trade in Germany the regulations of 1897 were passed to remedy

[1] Silberstein, in Weyl's Handbuch der Arbeiterkrankheiten. Jena, 1908, p. 251.
[2] Pannwitz, in Arbeiten aus dem kaiserlichen Gesundheitsamt, 1896, Vol. XII, p. 686.

unhealthful conditions in printing shops.[1] Pannwitz lays great stress on the poor physical development of those who enter the trade, and believes that the fact that narrow-chested boys, predisposed to tuberculosis, are especially apt to select this industry is one explanation for its high morbidity rate. People have the mistaken idea that the work is light, whereas really it is very strenuous, requiring both physical and nervous endurance. The hours of standing at a frame, not always adapted to the man's height, are more exhausting than work which involves walking and making larger muscular movements. The lack of movement causes shallow respiration and this results in gradual weakening of the lungs. There are in addition many common though quite preventable evils in the industry, such as poor ventilation, overcrowding, lack of cleanliness, and abundant production of dust.

Statistics of a few decades ago show a very high sickness rate among German printers and also a high death rate. In 1875 Stumpf[2] wrote that compositors and type founders had the highest death rate of all the trades and that they suffered especially from pulmonary and digestive diseases. Albrecht[3] writing in 1891 classed the printing trade among the more dangerous industries and emphasized the respiratory diseases especially. Wegmann[4] compared the deaths of Berlin printers with those of men in other industries in the years 1886 and 1887. Out of 1,000 printers employed 16.8 died, while in other trades out of an equal number of men the turners lost 13.8, the painters 11.9, the weavers 11.4, the shoemakers 11.3, the carpenters 11.1, and the tailors 9.

Following the passage of the law of 1897, there was a decided improvement in sanitary conditions in printing shops and since that time there has been a corresponding improvement in the sickness and death records of this industry especially in some of the large cities. Thus Hahn[5] whose careful study of this trade was published in 1908 shows that while the printers' union in Germany with 54,000 members had a higher sickness rate than the average for all trades in the German sick funds for 1891 to 1904—46.10 per 100 printers, 37.58 per 100 members of the sick insurance funds—in three cities the sickness rate for printers had fallen below the average, and the death rate also was lower.

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[1] For present German regulations, see Appendix E, p. 117 et seq.

[2] Stumpf, in Archiv der Heilkunde, 1875, vol. 16, p. 465.

[3] Albrecht, in Schmoller's Jahrbuch für Gesetzgebung 1891, Heft 2, p. 213; also quoted in Weyl's Handbuch der Arbeiterkrankheiten. Jena, 1908, p. 254.

[4] Wegmann, in Archiv für Hygiene, 1894, vol. 21, p. 359.

[5] Hahn, M.: Die Gesundheitsverhältnisse im polygraphischen Gewerbe Deutschlands, mit besonderer Berücksichtigung der Bleivergiftung. Bericht an die Internationale Vereinigung für gesetzliche Arbeiterschutz, 1908.

TABLE 6.—DEATH RATES PER 1,000 FOR THE PRINTING TRADES AND FOR ALL TRADES IN THREE GERMAN CITIES, 1891 TO 1904.

[Source: Die Gesundheitsverhältnisse im polygraphischen Gewerbe Deutschlands, 1908, p. 15.]

City.	All trades.	Printing trades.[1]
Berlin	12.6	9.2
Munich	8.9	5.7
Dresden	8.4	6.7

[1] Rates for Berlin include male book printers only; those for Munich and Dresden include all printing trades, both sexes.

As we shall see later, however, printers even in these cities have an excessive death rate from tuberculosis.

The following table, based on the experience of the Leipsig (Germany) Local Sick Fund, 1887 to 1905, shows the death rates due to all causes and to certain selected causes for several occupations in the printing industry and for other selected occupations. Printers and painters (lead-using occupations) are conspicuous for high rates both from all causes and from tuberculosis. Unfortunately, the experience in later years is not shown separately, and the changes which may have occurred in the rates between the earlier and later years of this long period can not be determined from any information available.

TABLE 7.—DEATHS DUE TO ALL CAUSES AND TO SPECIFIED CAUSES PER 1,000 MEMBERS IN CERTAIN OCCUPATIONS OF THE LEIPSIG LOCAL SICK FUND, 1887 TO 1905.

[Source: Twenty-fourth Annual Report of the United States Commissioner of Labor, pp. 1342–1347.]

Occupation.	Persons under observation one year.	Deaths, per 1,000 persons, from—			
		All causes.	Diseases of the respiratory organs.	Tuberculosis of all kinds.	Injuries and other external influences.
MALES 25 TO 34 YEARS OF AGE.					
Compositors	8,508	7.99	0.94	4.58	0.24
Type founders, etc	2,196	5.46	.91	3.19	.....
Bookbinders	3,685	4.88	.81	2.99	.....
Painters	6,305	5.39	1.11	2.85	.32
Shoemakers	3,992	6.51	.75	2.76	.75
Carpenters, roofers, etc	8,133	4.55	.61	1.60	.98
Joiners	14,797	5.07	.74	2.57	.27
Bookkeepers, cashiers, copyists, stenographers, draftsmen, etc	25,300	6.88	1.26	2.61	.16
Shop employees, salesmen, clerks, etc	4,071	4.67	1.23	1.97	.....
Laborers in agriculture, gardening, etc	3,502	4.00	.86	1.14	.29
MALES 35 TO 54 YEARS OF AGE.					
Compositors	7,129	10.24	1.12	4.21	.14
Type founders, etc	2,033	19.68	1.97	4.43	.....
Bookbinders	2,781	6.47	1.08	2.52	.36
Painters	4,164	13.69	2.64	3.12	1.20
Shoemakers	1,965	14.76	1.02	4.07	1.02
Carpenters, roofers, etc	9,973	8.02	2.01	2.01	.90
Joiners	13,337	10.50	1.95	3.82	.37
Bookkeepers, cashiers, copyists, stenographers, draftsmen, etc	13,857	11.33	2.24	2.89	.14
Shop employees, salesmen, clerks, etc	1,210	13.22	3.31	4.13	.....
Laborers in agriculture, gardening, etc	4,176	16.04	5.27	4.07	1.68

TABLE 7.—DEATHS DUE TO ALL CAUSES AND TO SPECIFIED CAUSES PER 1,000 MEMBERS IN CERTAIN OCCUPATIONS OF THE LEIPSIG LOCAL SICK FUND, 1887 TO 1905—Concluded.

Occupation.	Persons under observation one year.	Deaths, per 1,000 persons, from—			
		All causes.	Diseases of the respiratory organs.	Tuberculosis of all kinds.	Injuries and other external influences.
FEMALES 25 TO 34 YEARS OF AGE.					
Printers' helpers	1,427	9.81	1.40	5.61	0.70
Bookbinders	2,935	6.81	.68	4.09	.....
Laundresses, ironers, etc	1,212	2.48	.....	.....	.....
Bookkeepers, cashiers, copyists, stenographers, draftswomen, etc	2,803	2.85	.....	.71	.....
Shop employees, saleswomen, clerks, etc	4,496	4.00	.89	1.11	.....
Gardening, agriculture, and forestry	2,515	5.57	.40	.80	.....
FEMALES 35 TO 54 YEARS OF AGE.					
Printers' helpers	538	9.29	3.72	1.86	.....
Bookbinders	1,300	8.46	1.54	3.85	.....
Laundresses, ironers, etc	1,750	6.86	.57	2.86	.....
Bookkeepers, cashiers, copyists, stenographers, draftswomen, etc	735	5.44	1.36	1.36	.....
Shop employees, saleswomen, clerks, etc	912	5.48	1.10	1.10	.....
Gardening, agriculture, and forestry	4,639	5.60	1.29	1.29	.22

The experience of the Leipsig Local Sick Fund also permits comparisons of the amount of sickness among compositors, type founders, and other occupations. The compositors show notably high sickness rates from tuberculosis and from diseases of the nervous system. Two other occupations in which exposure to lead is even greater than in the case of compositors, namely, type founders and painters, show rates for diseases of the nervous system considerably below those of compositors. Diseases of the nervous system are most serious among clerical and shop employees.

TABLE 8.—ANNUAL DAYS OF SICKNESS PER 1,000 MEMBERS OF THE LEIPSIG LOCAL SICK FUND ENGAGED IN CERTAIN OCCUPATIONS, BY CAUSES, 1887 TO 1905.

[Source: Twenty-fourth Annual Report of the United States Commissioner of Labor, pp. 1342–1347.]

Occupation.	Persons under observation one year.	Number, per 1,000 persons, of—									
		Cases of sickness.	Days of sickness.	Days of sickness due to—							
				Diseases of the respiratory organs.	Tuberculosis of all kinds.	Diseases of the nervous system.	Diseases of the circulatory system.	Diseases of the digestive system.	Diseases of the external organs.	Diseases of the organs of locomotion.	Diseases of the eye (including injuries).
MALES 25 TO 34 YEARS OF AGE.											
Compositors	8,508	378	11,852	2,419	1,453	843	431	1,373	478	773	128
Type founders, etc	2,196	401	9,784	2,465	885	166	248	1,012	310	767	44
Bookbinders	3,685	274	6,936	1,240	897	424	163	1,026	280	772	113
Painters	6,305	439	9,767	1,344	935	253	441	939	407	1,141	169
Shoemakers	3,992	292	6,831	1,386	971	303	319	927	549	563	191
Carpenters, roofers, etc	8,133	370	7,044	1,109	367	293	127	878	422	943	77
Joiners	14,797	347	7,133	1,335	629	349	237	884	468	633	100

TABLE 8.—ANNUAL DAYS OF SICKNESS PER 1,000 MEMBERS OF THE LEIPSIC LOCAL SICK FUND ENGAGED IN CERTAIN OCCUPATIONS, BY CAUSES, 1887 TO 1905—Concluded.

Occupation.	Persons under observation one year.	Number, per 1,000 persons, of—									
		Cases of sickness.	Days of sickness.	Days of sickness due to—							
				Diseases of the respiratory organs.	Tuberculosis of all kinds.	Diseases of the nervous system.	Diseases of the circulatory system.	Diseases of the digestive system.	Diseases of the external organs.	Diseases of the organs of locomotion.	Diseases of the eye (including injuries).
MALES 25 TO 34 YEARS OF AGE—con.											
Bookkeepers, cashiers, copyists, stenographers, draftsmen, etc.	25,300	195	4,702	929	560	624	266	563	168	326	80
Shop employees, salesmen, clerks, etc.	4,071	165	3,680	628	176	527	254	617	175	190	109
Laborers in agriculture, gardening, etc.	3,502	334	5,998	905	270	142	85	651	536	782	105
MALES 35 TO 54 YEARS OF AGE.											
Compositors	7,129	358	14,103	2,194	1,560	1,238	547	1,094	596	1,647	322
Type founders, etc.	2,033	399	13,067	2,098	958	1,012	252	1,108	504	1,853	170
Bookbinders	2,781	295	9,842	1,462	1,038	1,177	521	1,198	560	1,252	210
Painters	4,164	490	14,200	1,885	1,260	1,045	312	1,117	699	1,972	160
Shoemakers	1,965	330	9,010	2,070	1,004	1,040	490	901	520	907	237
Carpenters, roofers, etc.	9,973	414	10,097	1,661	583	529	325	891	674	1,633	88
Joiners	13,337	380	9,523	1,706	849	732	343	1,109	604	1,138	130
Bookkeepers, cashiers, copyists, stenographers, draftsmen, etc.	13,857	234	6,737	1,122	644	1,249	369	655	228	713	210
Shop employees, salesmen, clerks, etc.	1,210	215	6,338	880	641	1,469	605	621	199	618	207
Laborers in agriculture, gardening, etc.	4,176	535	12,330	2,381	938	625	405	1,054	1,124	1,706	209
FEMALES 25 TO 34 YEARS OF AGE.											
Printers' helpers	1,427	549	14,671	2,124	1,304	706	699	2,094	554	504	131
Bookbinders	2,935	505	13,812	2,047	951	468	374	1,936	859	632	32
Laundresses, ironers, etc.	1,212	397	8,908	1,380	23	312	176	1,500	642	726	20
Bookkeepers, cashiers, copyists, stenographers, draftswomen, etc.	2,803	244	6,158	1,144	286	810	269	696	116	324	20
Shop employees, saleswomen, clerks, etc.	4,496	279	7,550	1,108	200	501	397	1,364	270	343	97
Gardening, agriculture and forestry	2,515	522	10,913	1,412	258	363	161	2,133	734	1,198	235
FEMALES 35 TO 54 YEARS OF AGE.											
Printers' helpers	538	610	18,723	1,989	599	1,444	907	3,556	472	1,320	20
Bookbinders	1,300	477	16,378	3,550	1,475	978	693	2,195	1,184	1,170	78
Laundresses, ironers, etc.	1,750	402	11,223	1,830	509	747	439	1,549	1,965	1,200	94
Bookkeepers, cashiers, copyists, stenographers, draftswomen, etc.	735	231	7,072	1,143	512	1,464	188	716	152	263	.....
Shop employees, saleswomen, clerks, etc.	912	190	6,493	921	354	1,113	293	382	249	854	308
Gardening, agriculture and forestry	4,639	589	14,157	2,395	281	434	517	2,363	1,141	2,117	227

The German statistics which give deaths according to age periods do not show the excessive mortality in the early groups that we have seen in the Dutch records or even in the Italian. Evidently the employment of children in the industry is not as common in Germany as in those countries.

Tuberculosis is the great enemy of the printer. Wherever his death rate has been found to be high the cause has been found in a disproportionately large number of deaths from pulmonary tuberculosis. This is found in the records of all countries.

The table following shows for England and Wales the comparative mortality rates from tuberculosis and from all causes. Comparative figures are given for all males, for occupied males, and for printers, the per cent of deaths due to tuberculosis having been computed for each of these classes. The table shows that tuberculosis was the cause of 31 per cent of the deaths among printers, and that only 18.6 per cent of the deaths among all males and 18.9 per cent among occupied males were from this cause.

TABLE 9.—COMPARATIVE MORTALITY OF MALES AGED 25 TO 65 YEARS, FROM ALL CAUSES AND FROM TUBERCULOSIS: PRINTERS COMPARED WITH OCCUPIED MALES AND WITH ALL MALES IN ENGLAND AND WALES, 1900 TO 1902.

[Source: Supplement to Sixty-fifth Annual Report of Registrar General of Births, Deaths, and Marriages in England and Wales, Part II. London, 1908, pp. clviii, clxvii. The number of deaths among all males from all causes is used as a basis for comparison and considered as 1,000.]

Class.	All causes.	Tuberculosis.	Per cent of deaths due to tuberculosis.
All males	1.000	186	18.6
Occupied males	925	175	18.9
Printers	935	290	31.0

In the next table the mortality rates for printers from tuberculosis and from other diseases of the respiratory system are compared with those of all occupied males, by age periods. The death rates from tuberculosis are higher for the printers by from 0.49 to 2.11 per 1,000 than for the males of all occupations, the difference being most marked in the age group 35 to 44 years. For other diseases of the respiratory system the rate for printers is slightly excessive at ages under 20 and comparatively high at ages 65 and over, but is below the average at ages 20 to 64, inclusive.

TABLE 10.—MORTALITY FROM CONSUMPTION AND FROM OTHER DISEASES OF THE RESPIRATORY SYSTEM AMONG PRINTERS, COMPARED WITH THAT OF ALL OCCUPIED MALES IN ENGLAND AND WALES, 1900 TO 1902, BY AGE GROUPS.

[Source: The mortality from consumption in dusty trades, by Frederick L. Hoffman, in Bulletin No. 79, U. S. Bureau of Labor Statistics, compiled from data in Supplement to Sixty-fifth Annual Report of Registrar General of Births, Deaths, and Marriages in England and Wales, Part II, London, 1908.]

Age at death.	Mortality from consumption.				Mortality from other diseases of the respiratory system.			
	Death rate per 1,000 for all occupied males.	Death rate for printers.			Death rate per 1,000 for all occupied males.	Death rate for printers.		
		Rate per 1,000.	Greater (+) or less (−) than rate for all occupied males.	Ratio to rate for all occupied males.		Rate per 1,000.	Greater (+) or less (−) than rate for all occupied males.	Ratio to rate for all occupied males.
15 to 19 years	0.54	1.03	+0.49	191	0.24	0.36	+0.12	150
20 to 24 years	1.55	3.41	+1.86	220	.48	.37	− .11	77
25 to 34 years	2.03	3.65	+1.62	180	.77	.55	− .22	71
35 to 44 years	2.74	4.85	+2.11	177	1.66	1.24	− .42	75
45 to 54 years	3.04	4.27	+1.23	140	3.32	2.17	−1.15	65
55 to 64 years	2.16	3.42	+1.26	158	6.54	5.16	−1.38	79
65 years and over	1.11	1.60	+ .49	144	17.77	20.76	+2.99	117

In Holland, De Vooys selected certain trades for comparison with the printers and his figures, which are given in the table following, show unmistakably how high a death rate there is from tuberculosis among Dutch printers, especially in the early years of life.

TABLE 11.—DEATHS PER 1,000 DUE TO TUBERCULOSIS IN HOLLAND: PRINTERS COMPARED WITH FOUR OTHER SELECTED OCCUPATIONS AND WITH ALL OCCUPIED MALES, BY AGE GROUPS, 1896 TO 1900.

[Source: De Vooys, Bericht über Bleivergiftung in den polygraphischen Gewerben in den Niederlanden, 1908, p. 9.]

Occupation.	12 to 17 years.	18 to 22 years.	23 to 35 years.	36 to 50 years.	51 to 60 years.	61 to 65 years.	66 to 70 years.	71 years and over.	Total.
Printers	1.18	6.25	4.53	3.57	3.38	1.41	5.66	2.70	3.75
Shoemakers	.81	4.36	3.87	3.23	3.03	1.47	1.09	1.81	3.06
Painters	.77	2.96	3.11	3.17	3.33	2.97	3.87	.98	2.77
Carpenters	.79	2.61	3.03	2.80	2.91	3.91	4.22	1.50	2.58
Gardeners	.41	1.52	1.60	1.48	1.61	.68	.91	1.05	1.32
All occupied males	.54	2.39	2.48	2.25	2.43	2.24	2.20	1.36	2.13

Even the painters do not have as high a rate as the printers until the sixtieth year is passed.

Bertillon, in his study of 1891, already referred to, stated that in France and in Switzerland tuberculosis was very prevalent in this industry. Swiss printers had twice as high a death rate from tuberculosis in every age group as the population as a whole. The same statement is made concerning Swiss printing trades as has already been made concerning the trade in Germany and Austria, that part of its high sickness rate must be attributed to the

large number of underdeveloped apprentices who enter the printing trade because it is looked upon as light and easy work.

Carozzi gives statistics for Italy which demonstrate the same prevalence of tuberculosis among the printers there. He quotes a report of Felice Pollini for the printers of Milan during eight decades.

TABLE 12.—NUMBER AND PER CENT OF DEATHS DUE TO TUBERCULOSIS AMONG THE PRINTERS OF MILAN, BY DECADES, 1815 TO 1894.

[Source: Publication of International Association for Labor Legislation, Italian section, new series, No. 4, Pt. II, p. 45.]

Period.	Deaths from all causes.[1]	Deaths from tuberculosis.	
		Number.	Per cent.
1815 to 1824	62	26	41.9
1825 to 1834	95	46	48.4
1835 to 1844	115	59	51.3
1845 to 1854	162	76	46.9
1855 to 1864	234	112	47.9
1865 to 1874	[2] 175	[2] 101	.....
1875 to 1884	301	153	50.8
1885 to 1894	241	92	38.2

[1] The numbers in this column are as shown in the source given, but are not the correct sum of the death shown therein by causes.
[2] Data are incomplete for this period.

Carozzi's own figures are for the city of Milan, which is one of the centers of the printing trade of Italy, and he compares them with the general mortality for all Italy.

TABLE 13.—PER CENT OF DEATHS DUE TO TUBERCULOSIS IN THE GENERAL POPULATION OF ITALY, OF MILAN, AND IN THE TYPOGRAPHICAL TRADE IN MILAN.

[Source: Publication of International Association for Labor Legislation, Italian section, new series, No. 4, Pt. II, p. 36.]

Item.	Per cent of deaths due to tuberculosis.				
	1905	1906	1907	1908	1909
General population of Italy	12.09	12.11	12.43	12.19	12.23
General population of Milan	14.82	15.84	16.95	15.82	14.13
Typographical trade of Milan	41.33	50.84	43.39	48.68	35.93

In the Austrian Government report already referred to it is said that tuberculosis is the disease typical of the printing trades. The report, however, deals specially with the menace of lead, and the statistics, which are chiefly those of lead poisoning, will be given farther on.

In Germany all of the writers who have taken this trade as their subject state that tuberculosis is very prevalent among printers. Albrecht emphasizes the danger of respiratory diseases, especially tuberculosis, as shown in some early statistics from the Berlin sickness insurance office. Between 1857 and 1859, 48.13 per cent of all

deaths among printers were from pulmonary tuberculosis and when other kinds of tuberculosis were reckoned with them, the proportion was 50.2. If all respiratory diseases are included the proportion reaches 60.96.

Among the printers of Berlin deaths due to tuberculosis of the lungs during the period 1857 to 1889 were, according to Albrecht, 49.43 per cent of the deaths from all causes; for the period 1889 to 1891 Sommerfeld gives the proportion as 44.44 per cent; for 1901 to 1907 Hahn gives 37.7 per cent; and for 1903 to 1905 Silberstein reports that 37.33 per cent of the deaths among the printers of Berlin were due to this cause. The improvement in conditions which followed the passage of the law of 1897, is shown plainly in more recent statistics given by Silberstein although, as he says, tuberculosis is still unduly prevalent among German printers.

This decrease in tuberculosis in Berlin corresponds in general to the decrease in all Germany. However, even in those German cities in which the death rate among printers has been very notably lowered of late years, actually below that of the general population, yet if one takes the tuberculosis rates alone, the printers are always in the lead. For instance, in Munich, in 1907, tuberculosis caused 30.4 per cent of all deaths among members of the general sick fund, while among the printers 46.3 per cent were from this cause.[1] Hahn gives also the following figures for Berlin's mortality rate from tuberculosis of the lungs:

TABLE 14.—PER CENT OF DEATHS DUE TO TUBERCULOSIS AMONG MEMBERS OF THE GENERAL LOCAL SICK FUND AND OF THE PRINTERS' SICK FUND OF BERLIN.

[Source: Die Gesundheitsverhältnisse im polygraphischen Gewerbe Deutschlands, p. 21.]

Fund.	Per cent of deaths due to tuberculosis.		
	Males.	Females.	Both sexes.
General local sick fund (1902 to 1907)	29.5	33.1	30.9
Printers' sick fund (1901 to 1907)	37.2	39.4	37.7

UNITED STATES.

Several State and Federal inquiries have been made in the United States concerning health conditions in the printing trades. In a very complete report of the history of Typographical Union No. 6—the New York City printers' union—which was made in 1911 for the New York State Bureau of Labor Statistics, there is a long discussion of the healthfulness of the industry.[2] It is a subject which

[1] Die Gesundheitsverhältnisse im polygraphischen Gewerbe Deutschlands, p. 21.

[2] New York State Department of Labor. Annual Report for 1911. Vol. II. Albany, 1912.

has occupied the attention of the more intelligent class of printers for a long time, because it was evident to them that their trade had an undue amount of sickness and early breakdown. Nevertheless in this same report it is shown from the union's own books that a very notable improvement in the health and longevity of the members has taken place from decade to decade. Thus they show from their union statistics that the average duration of life for a compositor was only 28 years in 1850, while 18 years later, in 1868, it had risen to 35 years, and in 1893 to 38.78. The average age at death of printers in New York City during the five years ending with 1905 was 46.48, and for the five years ending with 1910 it was 49.44. For those who died from tuberculosis the average of 37.36 years at death in the first five-year period had risen to 42.42 in the second five-year period. During the first period 97 of the 508 printers who died had passed their sixtieth birthday, a proportion of 19.1 per cent, but during the later period 141 out of 583, or 24.2 per cent, were over 60 years of age.

The report also gives an account of the medical examination of 203 members of the union under the supervision of Dr. James Alexander Miller. Thirty-one per cent of them were found to be absolutely normal, 15 per cent (31) had evidence of tuberculosis, although it was active in only 16. The 16 per cent who had pleurisy were also possibly tuberculous. The only other complaints which affected large numbers were catarrh (27.5 per cent) and constipation (10.3 per cent). On the whole, with the exception of tuberculosis, the showing of this group of men is excellent.

The Illinois Commission on Occupational Diseases took up the printing trade as one of the industries in which lead is handled. Its report, published in 1911, not only considers the use of lead in printing, but it also states that the conditions found in printing establishments in Illinois were often very bad, and, though the work is not inherently dangerous, it may be made actually very unhealthful because of dirty, neglected premises, vitiated air, unnecessary dust and fumes, and lack of proper washing facilities.

The New York State Factory Investigating Commission in 1913 published a report concerning 348 printing plants employing 9,047 persons. These plants were chiefly in New York City. In the majority of cases the sanitary conditions were characterized as deplorable, the main defects being improper location, inadequate and improper lighting, lack of ventilating devices, sometimes very badly vitiated air, excessively high temperature, general neglect of cleanliness, and inadequate washing facilities. In addition to these possible causes of disease among printers the investigators mention the lack of exercise and the mental strain of the work.

In 1915 the Ohio State Board of Health issued a report on Industrial Health Hazards and Occupational Diseases in Ohio, prepared by Dr. E. R. Hayhurst. Thirty-four printing establishments, employing 2,715 persons, were visited. The complaints made by the workmen themselves had to do with poor ventilation, fumes, dust, and the necessity of working with men they believed to be tuberculous. The investigators found actually only 6 out of the 34 plants in model condition; in the other 28 the air was more or less badly vitiated, especially in those where gas was used.

The printing trade in Ohio, as everywhere, has more than its share of pulmonary tuberculosis. Vital statistics for 1910, 1911, and 1912 show that out of 273 deaths of compositors and pressmen 58, or 21.25 per cent, were from pulmonary tuberculosis, while in these same years the proportion of deaths from this disease among occupied males in general in Ohio was 13.3 per cent and among men in agricultural life only 7.13 per cent.[1]

It is interesting to compare Hayhurst's statistics of the ages of Ohio printers with those given by De Vooys[2] for Holland. The age groups do not quite correspond, but the difference in grouping is not great enough to make comparison impossible. The great difference is in the early age groups, there being a large proportion of youthful workers in Holland and a small proportion in Ohio.

TABLE 15.—PER CENT OF PRINTERS IN EACH AGE GROUP IN OHIO AND IN HOLLAND.

Ohio.[3]		Holland.	
Age group.	Per cent at each age.	Age group.	Per cent at each age.
Under 20 years	4.2	12 to 17 years	26.71
20 to 40 years	82.7	18 to 22 years	19.72
Over 40 years	13.1	23 to 35 years	30.14
		36 to 50 years	16.19
		51 to 60 years	5.13
		Over 60 years	3.11

The death records of the International Typographical Union are available for the period 1893–1915, and the nearly 12,000 deaths furnish the largest body of data anywhere existing in regard to the causes of deaths of printers. Most of the material here presented is taken from the January, 1917, issue of the MONTHLY REVIEW of the United States Bureau of Labor Statistics. The mortality experience of the International Typographical Union shows such marked improvement within this period as to suggest that possibly European data relating to experience prior to 1900 may not be fairly indicative of conditions in 1914. The supplement to the Typographical Journal

[1] Hayhurst, op. cit., p. 73.

[2] Bericht über Bleivergiftung in dem polygraphischen Gewerben in den Niederlanden, 1908, p. 6.

[3] Hayhurst, op. cit., p. 186.

for August, 1915 (p. 64), shows the membership, number of deaths, the deaths per 1,000 members, the per cent of deaths due to tuberculosis, and the average age at death for each year, 1900 to 1915, inclusive. During this period the membership increased from 32,105 in 1900 to 59,571 in 1915. During this same period the per cent of deaths due to tuberculosis decreased from 31.2 to 19.1, a slight decrease occurred in the death rate, and the average age at death showed an increase of over 9½ years. These facts are shown in detail in the following table:

TABLE 16.—DEATHS PER 1,000 MEMBERS, AVERAGE AGE AT DEATH, AND PER CENT OF DEATHS DUE TO TUBERCULOSIS OF THE LUNGS AMONG MEMBERS OF THE INTERNATIONAL TYPOGRAPHICAL UNION, 1900 TO 1915.

Year.	Members.	Number of deaths.	Deaths per 1,000.	Per cent of deaths due to tuberculosis.	Average age at death.
1900	32,105	419	13.00	31.2	41.25
1901	34,948	406	11.60	32.9	41.94
1902	[1] 38,364	474	12.35	31.2	42.94
1903	42,436	476	11.21	24.7	42.62
1904	[2] 46,165	578	12.52	19.8	45.50
1905	46,734	567	12.13	25.7	45.26
1906	44,980	512	11.40	25.2	44.02
1907	42,357	561	13.20	24.2	46.07
1908	43,740	538	12.30	23.8	45.05
1909	44,921	509	11.50	22.8	46.09
1910	47,848	574	12.00	22.5	46.07
1911	51,095	639	12.50	18.7	49.12
1912	53,807	655	12.50	21.3	48.09
1913	55,614	687	12.30	19.1	49.24
1914	58,537	713	12.18	15.9	48.70
1915	59,571	696	11.70	19.1	50.84

[1] Including stereotypers and electrotypers, 7 months. [2] Including photo-engravers, 7 months.

It is evident from this table that some important improvement in working conditions within this period is the cause of this marked improvement in the mortality experience among members of the International Typographical Union. The increase in membership within the period, accompanying a large expansion in the printing and publishing industry, has resulted in the entrance into the industry of many new workers, probably with a lowering of the average age of membership. A lowering of the average age of membership, however, would tend, temporarily at least, to reduce the death rate and the average age at death. The supplement to the Typographical Journal, from which the figures are quoted, presents as an explanation of this improvement the introduction of a shorter workday and improved sanitary conditions in the shops, due in large part to the activity of the health committees of the organization. It is probable also that the introduction of machine composition and the consequent reduction of lead poisoning has contributed in bringing about this improvement, since the indirect effects of lead poisoning among

printers are far more serious than its direct effect as a primary cause of death.

The table which follows gives the number of deaths due to all causes, the number of deaths due to tuberculosis, and the percentage of total deaths due to tuberculosis, by age groups, for the period 1893 to 1915. The figures are given for five-year periods except for 1913 to 1915, in order to eliminate the irregularities of individual years. The total number of deaths covered by the table is 11,746.

TABLE 17.—NUMBER OF DEATHS DUE TO ALL CAUSES AND NUMBER AND PER CENT DUE TO TUBERCULOSIS AMONG MEMBERS OF INTERNATIONAL TYPOGRAPHICAL UNION, BY AGE GROUPS, 1893 TO 1915.

Period.	15 to 24 years.	25 to 34 years.	35 to 44 years.	45 to 54 years.	55 to 64 years.	65 years and over.	Total.
	Deaths due to all causes.						
1893 to 1897	218	646	512	303	218	164	2,061
1898 to 1902	101	617	543	334	254	222	2,071
1903 to 1907	114	576	722	557	390	333	2,692
1908 to 1912	111	450	720	658	437	485	2,861
1913 to 1915	69	261	471	511	379	370	2,061
Total	613	2,550	2,968	2,363	1,678	1,574	11,746
	Deaths due to tuberculosis.						
1893 to 1897	106	348	175	86	25	8	748
1898 to 1902	47	300	204	66	19	15	651
1903 to 1907	37	255	235	80	28	10	645
1908 to 1912	47	193	227	112	32	8	619
1913 to 1915	22	95	137	81	27	7	369
Total	259	1,191	978	425	131	48	3,032
	Per cent, of total deaths, due to tuberculosis.						
1893 to 1897	48.6	53.9	34.2	28.4	11.5	4.9	36.3
1898 to 1902	46.5	48.6	37.6	19.8	7.5	6.8	31.4
1903 to 1907	32.5	44.3	32.5	14.4	7.2	3.0	24.0
1908 to 1912	42.3	42.9	31.5	17.0	7.3	1.7	21.6
1913 to 1915	31.9	36.4	29.1	15.9	7.1	1.9	17.9
Total	42.3	46.7	33.0	18.0	7.8	3.1	25.8

A study of the table shows that for all age groups combined the percentage of deaths due to tuberculosis has declined from 36.3 in the five-year period, 1893 to 1897, to 17.9 in the three-year period, 1913 to 1915. Marked reductions are apparent in every age group.

A comparison of the per cent of deaths due to tuberculosis among members of the International Typographical Union and among males in the registration area of the United States shows a large excess among the printers. The decline in recent years, however, has been much greater in the International Typographical Union than in the country as a whole. This is brought out in Table 18.

TABLE 18.—PER CENT OF TOTAL DEATHS DUE TO TUBERCULOSIS OF THE LUNGS: COMPARISON OF MALES IN REGISTRATION AREA OF THE UNITED STATES WITH MEMBERS OF INTERNATIONAL TYPOGRAPHICAL UNION.

Age group.	Males in registration area, United States.		Members International Typographical Union.	
	1900	1912 to 1914	1898 to 1902	1913 to 1915
15 to 24 years	28.3	25.7	46.5	31.9
25 to 34 years	32.0	29.1	48.6	36.4
35 to 44 years	23.5	23.0	37.6	29.1
45 to 54 years	15.2	14.1	19.8	15.9
55 to 64 years	8.6	7.5	7.5	7.1
65 years and over	3.1	2.3	6.8	1.9
Total	15.2	12.7	31.4	17.9

It will be of interest to compare the per cent of total deaths due to tuberculosis of the lungs among the members of the International Typographical Union with similar figures for white males 15 years of age and over in the registration area of the United States and for printers in the industrial membership of the Metropolitan and Prudential insurance companies. The result of such comparison is shown in Table 19. In making this comparison it is important to note that the average age at death of members of the International Typographical Union in 1915 was 50.8 years, the high point, following a fairly steady increase since 1900. The Metropolitan experience for 1911 to 1913 shows for printers an average age at death of 40.2 years.

TABLE 19.—PER CENT OF TOTAL DEATHS DUE TO TUBERCULOSIS OF THE LUNGS.

	15 to 24 years.	25 to 34 years.	35 to 44 years.	45 to 54 years.	55 to 64 years.	65 years and over.	Total 15 years and over.
International Typographical Union, 1913–1915.	31.9	36.4	29.1	15.9	7.1	1.9	17.9
Printers, Metropolitan Life Insurance Co, 1911–1913	45.2	49.8	39.1	23.9	15.8	3.1	34.1
Printers, Prudential Insurance Co., 1907–1910.	49.8	49.5		21.9		4.7	38.4
Registration area, United States, 1909 (white males)	29.0	31.0	23.6	14.4	7.5	2.8	15.2

The explanation of the great differences in age at death and percentage of deaths due to tuberculosis between the industrially insured printers and the members of the International Typographical Union is not known.

In Table 20 is shown the per cent of total deaths due to each specified cause among members of the International Typographical Union for the same period, 1893 to 1915. The percentages are given in a form similar to that used in Table 17. One of the difficulties of the percentage method of presenting mortality statistics must

be borne in mind in studying this table. The reduction of the per cent of total deaths due to tuberculosis from 36.3 to 17.9 in the period covered means the transfer of 18.4 per cent of the deaths from this cause to other causes shown in the table. This is obvious from the very fact that the total of all deaths expressed as 100 per cent is taken as a basis for all the computations.

TABLE 20.—PER CENT OF TOTAL DEATHS DUE TO SPECIFIED CAUSES, AMONG MEMBERS OF INTERNATIONAL TYPOGRAPHICAL UNION, BY AGE GROUPS, 1893 TO 1915.

Period.	Per cent of total deaths due to—						
	Tuberculosis of the lungs.						
	15 to 24 years.	25 to 34 years.	35 to 44 years.	45 to 54 years.	55 to 64 years.	65 years and over.	Total.
1893 to 1897	48.6	53.9	34.2	28.4	11.5	4.9	36.3
1898 to 1902	46.5	48.6	37.6	19.8	7.5	6.8	31.4
1903 to 1907	32.5	44.3	32.5	14.4	7.2	3.0	24.0
1908 to 1912	42.3	42.9	31.5	17.0	7.3	1.7	21.6
1913 to 1915	31.9	36.4	29.1	15.9	7.1	1.9	17.9
Total	42.3	46.7	33.0	18.0	7.8	3.1	25.8
	Pneumonia.						
1893 to 1897	7.8	5.3	8.6	8.6	9.2	9.1	7.6
1898 to 1902	9.9	7.1	8.7	9.9	11.0	5.9	8.5
1903 to 1907	11.4	9.4	9.0	10.6	10.3	8.7	9.6
1908 to 1912	5.4	7.8	8.6	7.9	10.6	9.0	8.6
1913 to 1915	2.9	5.4	8.3	8.6	6.6	11.1	8.0
Total	7.8	7.1	8.7	9.1	9.5	9.0	8.5
	Other respiratory diseases.						
1893 to 1897	1.4	2.8	4.3	2.0	1.8	7.1	6.5
1898 to 1902	3.0	3.1	2.8	3.9	8.3	5.0	4.0
1903 to 1907	2.6	2.3	2.2	2.9	4.1	4.8	3.0
1908 to 1912	.9	.9	2.9	2.9	3.0	4.7	2.8
1913 to 1915	2.9	1.5	.4	2.0	2.9	2.7	2.0
Total	2.0	2.3	2.6	2.7	3.9	4.6	3.6
	Heart disease.						
1893 to 1897	2.3	2.8	4.5	5.9	9.2	6.7	4.6
1898 to 1902	1.0	3.7	4.8	6.6	11.8	9.0	5.9
1903 to 1907	3.5	3.8	5.1	8.3	13.3	14.4	7.8
1908 to 1912	3.6	6.0	7.5	11.7	14.9	17.3	10.9
1913 to 1915	5.8	5.7	7.6	10.2	14.2	13.8	10.3
Total	2.9	4.1	5.9	9.1	13.2	13.6	8.0
	Apoplexy and paralysis.						
1893 to 1897	2.3	1.7	5.1	8.9	14.2	22.6	6.6
1898 to 1902	2.0	1.9	3.9	11.1	11.8	18.0	6.9
1903 to 1907	.9	2.3	5.0	8.3	14.1	15.3	7.5
1908 to 1912	.9	2.9	4.7	6.7	11.9	12.6	7.2
1913 to 1915	5.8	3.1	6.6	10.6	13.5	17.0	10.2
Total	2.1	2.2	5.0	8.8	13.1	16.0	7.6

TABLE 20.—PER CENT OF TOTAL DEATHS DUE TO SPECIFIED CAUSES, AMONG MEMBERS OF INTERNATIONAL TYPOGRAPHICAL UNION, BY AGE GROUPS, 1893 TO 1915—Concluded.

Period.	Per cent of total deaths due to—						
	Bright's disease and nephritis.						
	15 to 24 years.	25 to 34 years.	35 to 44 years.	45 to 54 years.	55 to 64 years.	65 years and over.	Total.
1893 to 1897	1.4	1.4	5.5	5.0	10.1	7.9	4.4
1898 to 1902	4.0	4.5	6.1	8.4	12.2	10.8	7.1
1903 to 1907	4.4	3.1	6.4	11.1	10.8	14.4	8.2
1908 to 1912	.9	3.8	7.1	9.6	14.2	12.8	8.9
1913 to 1915	2.9	3.8	7.0	10.4	10.0	10.5	8.5
Total	2.7	3.2	6.4	9.4	11.6	11.8	7.6
	Diseases of digestive system.						
1893 to 1897	4.2	6.2	5.8	5.0	6.0	6.7	5.7
1898 to 1902	7.9	3.6	4.8	7.5	5.9	5.9	5.3
1903 to 1907	7.9	3.8	6.3	9.5	6.9	4.8	6.4
1908 to 1912	7.2	5.3	6.3	10.2	6.7	5.6	7.0
1913 to 1915	7.2	6.8	9.1	8.2	6.1	5.1	7.3
Total	6.5	5.0	6.4	8.5	6.4	5.5	6.4
	Cancer.						
1893 to 1897	.....	0.2	2.1	3.6	2.3	2.4	1.6
1898 to 1902	.....	.8	1.7	3.3	2.8	3.6	1.9
1903 to 1907	.....	.5	1.8	3.6	4.1	3.9	2.4
1908 to 1912	1.8	.9	1.9	5.0	6.9	7.4	4.2
1913 to 1915	1.4	.4	2.3	3.7	7.1	4.3	3.6
Total	.5	.5	2.0	4.0	5.1	4.9	2.8
	Accident.						
1893 to 1897	8.3	7.3	7.0	6.6	4.6	1.2	6.5
1898 to 1902	5.9	5.0	6.3	6.6	3.9	2.7	5.3
1903 to 1907	5.3	8.7	7.5	6.6	6.4	1.8	6.6
1908 to 1912	10.8	7.3	7.4	4.1	2.5	2.5	5.2
1913 to 1915	14.5	9.2	4.9	4.3	3.7	3.8	5.2
Total	8.5	7.3	6.7	5.4	4.2	2.5	5.7
	All other causes.						
1893 to 1897	23.9	18.8	22.7	26.1	32.3	31.0	23.7
1898 to 1902	19.8	21.6	23.6	23.1	24.9	32.5	23.8
1903 to 1907	32.6	21.8	24.0	24.9	22.8	28.8	24.5
1908 to 1912	26.1	22.3	22.0	25.1	21.8	26.4	23.6
1913 to 1915	24.6	27.7	24.6	26.3	28.8	29.7	27.1
Total	25.2	21.6	23.3	25.0	25.3	29.1	24.4

From a study of this table there is indicated no change in the percentage of deaths due to accident and to pneumonia, but a marked decline in the deaths due to other respiratory diseases, and an apparent increase in the percentage of deaths due to heart disease, apoplexy and paralysis, Bright's disease and nephritis, diseases of the digestive system, and cancer.

A careful comparison of the causes of death in the earlier and later years of the period covered in the above table shows that what has actually happened in recent years is that as an increasing proportion of the printers have reached old age they have in increasing numbers become subject to and have died of diseases of age—heart disease, apoplexy and paralysis, and Bright's disease and nephritis—but an increasing proportion of the deaths which are due to these diseases have occurred at advanced ages. This will be seen quite clearly in the table which follows. Thus, in the period 1893 to 1897, 48.4 per cent of the deaths due to heart disease were deaths of printers under 45 years of age, and only 32.7 per cent occurred at 55 years or over. In 1913 to 1915, the last period shown, however, only 26 per cent of the deaths from heart disease were under 45 years, and 49.6 per cent were in the group 55 years and over. A similar shifting of the deaths from old-age causes from the younger to the older age groups is shown in the table.

TABLE 21.—PER CENT OF TOTAL DEATHS DUE TO SPECIFIED CAUSE WHICH OCCURRED IN SPECIFIED AGE GROUPS, 1893 TO 1915.

Period.	15 to 24 years.	25 to 34 years.	35 to 44 years.	45 to 54 years.	55 to 64 years.	65 years and over.
Tuberculosis of the lungs:						
1893 to 1897	14.2	46.5	23.4	11.5	3.3	1.1
1898 to 1902	7.2	46.1	31.3	10.1	2.9	2.3
1903 to 1907	5.7	39.5	36.4	12.4	4.3	1.6
1908 to 1912	7.6	31.2	36.7	18.1	5.2	1.3
1913 to 1915	6.0	25.7	37.1	22.0	7.3	1.9
Heart disease:						
1893 to 1897	5.3	18.9	24.2	18.9	21.1	11.6
1898 to 1902	.8	18.8	21.3	18.0	24.6	16.4
1903 to 1907	1.9	10.5	17.7	22.0	24.9	23.0
1908 to 1912	1.3	8.7	17.4	24.8	20.9	27.0
1913 to 1915	1.9	7.1	17.0	24.5	25.5	24.1
Apoplexy and paralysis:						
1893 to 1897	3.6	8.0	19.0	19.7	22.6	27.0
1898 to 1902	1.4	8.5	14.8	26.1	21.1	28.2
1903 to 1907	.5	6.4	17.8	22.8	27.2	25.2
1908 to 1912	.5	6.3	16.6	21.5	25.4	29.8
1913 to 1915	1.9	3.8	14.7	25.6	24.2	29.0
Bright's disease and nephritis:						
1893 to 1897	3.3	10.0	31.1	10.7	24.4	14.4
1898 to 1902	2.7	18.9	22.3	18.9	20.9	16.2
1903 to 1907	2.2	8.1	20.8	28.1	19.0	21.7
1908 to 1912	.4	6.6	19.9	24.6	24.2	24.2
1913 to 1915	1.1	5.7	18.9	30.3	21.7	22.3
Diseases of digestive system:						
1893 to 1897	7.6	33.9	25.4	12.7	11.0	9.3
1898 to 1902	7.3	20.2	23.9	22.9	13.8	11.9
1903 to 1907	5.2	12.7	26.6	30.6	15.6	9.2
1908 to 1912	4.0	11.9	22.9	33.3	14.4	13.4
1913 to 1915	3.3	12.0	28.7	28.0	15.3	12.7

The effect of lead in causing deaths from heart disease, apoplexy and paralysis, and Bright's disease and nephritis has been the subject of some controversy. To throw light upon this question, some comparisons have been made of the experience of the membership of the International Typographical Union and of the deaths among white males in the registration area of the United States. These latter deaths would seem to furnish a reasonable basis for comparison,

representing as they do all occupied and unoccupied white males 15 years of age and over. There has also been included in the comparison the experience of the Metropolitan Life Insurance Company covering white males in all occupations 15 years of age and over. It is probably to be expected that the experience in this last group, limited as it is to industrial policy holders, will be somewhat less favorable than that of the white males of the registration area. The results of the comparisons are shown in Table 22.

TABLE 22.—PER CENT OF TOTAL DEATHS DUE TO SPECIFIED CAUSE WHICH OCCURRED UNDER 45 YEARS AND PER CENT WHICH OCCURRED AT 55 YEARS AND OVER—INTERNATIONAL TYPOGRAPHICAL UNION COMPARED WITH WHITE MALES 15 YEARS OF AGE AND OVER IN REGISTRATION AREA OF THE UNITED STATES AND WHITE MALE INDUSTRIAL EXPERIENCE, METROPOLITAN LIFE INSURANCE CO.

	Per cent of total deaths due to specified causes which were in age groups—	
	Under 45 years.	55 years and over.
Heart disease:		
United States registration area, 1909	18.6	64.8
Metropolitan Life Insurance Co., all occupations	22.2	61.4
International Typographical Union (1913–1915)	26.0	49.6
Apoplexy and paralysis:		
United States registration area, 1909	9.1	76.6
Metropolitan Life Insurance Co., all occupations	9.6	75.5
International Typographical Union (1913–1915)	20.4	54.1
Bright's disease and nephritis:		
United States registration area, 1909	20.6	59.5
Metropolitan Life Insurance Co., all occupations	22.6	57.0
International Typographical Union (1913–1915)	25.7	44.0

The method of comparison, it will be noticed, is to ascertain what per cent of the total deaths due to each of the selected causes occur under 45 years of age and what per cent occur at 55 years or later. The theory, of course, is that we may assume in the case of these diseases, all of which are old-age diseases, that, where a person died before 45 years of age, the death from such a cause is evidence of premature aging. Forty-five years was taken as sufficiently conservative to put the assumption beyond controversy. On the other hand, a high per cent dying at 55 years and over appears to be a favorable indication.

Examining then the figures of the table, we find that, while among white males in the registration area 18.6 per cent of all the deaths from heart disease occurred under 45 years, among members of the International Typographical Union, in 1913 to 1915, 26 per cent of the deaths from heart disease were in that early age group. Among the deaths from apoplexy and paralysis a much greater excess appears, 9.1 per cent of the deaths from these causes occurring

under 45 years among males in the registration area and 20.4 per cent among members of the International Typographical Union. The excess in deaths from Bright's disease and nephritis appears to be comparatively small, 20.6 per cent of the deaths from this cause occurring under 45 years among males in the registration area and 25.7 per cent among members of the International Typographical Union. If, however, we examine the next 10-year group, 45 to 54 years, we find the percentage for males in the registration area to be 19.9, while for members of the International Typographical Union it is 30.3. Apparently then the excess of Bright's disease and nephritis developed somewhat later than that of heart disease, and apoplexy and paralysis, but if the record is followed up to 54 years, we find an excess which it would seem to be proper to refer to an occupational cause.

It will be noted that, when the figures for the Metropolitan Life Insurance Company are studied, the percentage of deaths due to the specified causes which occur under 45 years is excessive as compared with males of the registration area, but that the excess is not so great as in the case of members of the International Typographical Union. It is probable that the explanation of this difference is to be found in the very high percentage of deaths due to tuberculosis of the lungs among the industrial membership of the Metropolitan Company.

These comparisons seem to indicate that something in the printing trades tends to produce an excess of early deaths from heart disease, apoplexy and paralysis, and Bright's disease and nephritis. But Table 21 shows that this excess has diminished in the last 20 years.

LEAD POISONING AMONG PRINTERS.

It is impossible to understand clearly the discussions concerning what are and what are not occupational diseases of printers without a careful consideration of the part played by lead in the causation of disease. The question of lead poisoning in the printing trades must be taken up as a separate problem, for there is a wide diversity of opinion concerning the importance of the presence of lead in this industry, some authorities believing it to be the most important factor in the causation of disease, even of tuberculosis, while others, though they consider printing a distinctly unhealthful trade, do not believe that the lead is responsible. No one claims that acute lead poisoning is common among printers. Lead colic, lead convulsions, even the lead line, are admitted by all to be very rare and when they do occur it is usually in a young man naturally oversusceptible to lead. As far back as 1858 Van Holsbeek,[1] of Brussels, in a report on the printing

[1] Van Holsbeek, in Journal de Médicine de Bruxelles, 1858, vol. 27, p. 30.

trade said that he found printer's colic much less common then than it used to be because of greater cleanliness among printers who no longer held type in their mouths as they formerly did. Only occasionally was there a case of lead poisoning in a young printer and then it was usually not severe.

The disagreement concerns the degree to which printers are exposed to lead poisoning, the prevalence among printers of the obscurer forms of chronic lead poisoning, and the part played by lead absorption in the development of other diseases, especially tuberculosis. It is agreed that there is still a decided danger of lead poisoning in type founding and finishing, much greater than in composing or in the other branches of the trade. Stumpf[1] found that of the men treated for lead poisoning in the Leipsig clinic in 1872 there were twice as many founders as compositors. Hirt[2] puts the proportion as one compositor to five founders. The danger is practically limited to these two classes if we include stereotypers among the founders. Hahn says that from 60 to 90 per cent of all cases of lead poisoning in the printing trade are among these two classes of men. There was only 1 case of lead poisoning in 600 cases of illness in a group of Bavarian photo-engravers, lithographers, and copper-plate workers.

Where type founders are not included the rate of lead poisoning clearly recognized as such is certainly not high. Silberstein found in Berlin in 1903, among 8,699 men compositors and pressmen, 65 cases, a rate of 0.75 per cent; among 4,039 male helpers, 12 cases, or less than 0.3 per cent; and among 5,081 women, only 4 cases. According to Sommerfield[3] lead poisoning accounted for only 1.7 per cent of the sickness among male printers in 1903 and only 0.8 per cent of the sickness among apprentices. In spite of this excellent showing, however, Kaup,[4] one of the most experienced Germans in the field of industrial hygiene, says that he considers that compositors are subject to a decided danger of poisoning from lead. He even puts printing fourth in the list of dangerous lead trades, the first of which is making white lead and red lead, the second smelting lead and zinc, and the third painting. Kaup says, moreover, that more than half the cases of severe lead poisoning in this industry are among the type setters. Roth[5] also believes there is a decided danger from lead, and points out the fact that with the introduction of linotype and monotype machines the dangers formerly confined to type founders have been introduced into the composing rooms. Albrecht says that lead is insignificant as a cause of death among printers but important as a cause of sickness. Sommerfeld believes that, next to painters, the

[1] Stumpf, in Archiv der Heilkunde, 1875, vol. 16, p. 471.
[2] Hirt, quoted by Silberstein.
[3] In Weyl's Handbuch der Arbeiterkrankenheiten. Jena, 1908, p. 257.
[4] Kaup, in Archiv für Sozial Hygiene, 1911, Vol. VI, p. 1.
[5] Roth, in Kompendium der Gewerbekrankheiten. Berlin, 1909, p. 79.

printers suffer most from chronic lead poisoning. He emphasizes the danger of lead dust from the lead which is allowed to fall on the floor.

In the report of the Austrian Government already quoted the typographical trade is placed among those which expose the workers to a constant danger from lead poisoning. Not only do lead poisoning and tuberculosis go hand in hand in this industry, but the lead is apparently responsible, at least in part, for the large amount of neurasthenia among compositors.[1] Statistics of plumbism in this industry can always be only tentative, since many cases fail to be correctly diagnosed, chronic poisoning being so varied in its manifestations. However, in a printers' union in Vienna which had an average of 7,000 members there was an annual average of 155 clear cases of lead poisoning during a period of six years. The women foundry helpers had much the highest rate, one in 9 employed; the male type founders, one in 15; the compositors, one in 35; pressmen and mechanics, one in 40; male helpers, one in 68; women not in the foundry, one in 265.

The table following shows the average annual number of cases of sickness per 100 members in this industry in Austria during the six years 1901 to 1906 among about 9,000 workers and the cases of lead poisoning per 100 members:

TABLE 23.—AVERAGE NUMBER OF CASES OF SICKNESS AND OF LEAD POISONING PER 100 MEMBERS PER YEAR IN SPECIFIED OCCUPATIONS, 1901 TO 1906.

[Source: Arbeitsstatistisches Amt Bleivergiftungen in hüttenmännischen und gewerblichen Betrieben. Vienna, 1909, Vol. VII, p. 3.]

Item.	Average annual number of cases per 100 members.			
	Pressmen.	Stereotypers.	Women in type foundry.	Compositors.
Sickness of all kinds	45.61	48.55	68.92	53.33
Lead poisoning	2.47	6.64	10.81	2.83

Pressmen are exposed to lead only in handling stereotype plates or colored inks, which may contain white lead or lead chromate or the oxides. Compositors get lead on their hands during their work and they may breathe dust from the type cases, especially if they shake them to get at the lower letters or to blow out the dust with bellows. Stereotypers and founders get lead on their hands and may also breathe lead dust from the trimmings and filings. There is a great deal of lead poisoning among the women who finish, sort, and pack type. Teleky,[2] of Vienna, thinks that while typical lead poisoning is rare, obscure forms of digestive disturb-

[1] Compare pages 67 and 91.

[2] Teleky: Wiener klinische Wochenscrift, 1907, nr. 48.

ance and kidney trouble in printers should sometimes be attributed to the absorption of lead, for they are certainly more common among these men than among wageworkers in general. Sternberg, chief physician for many years to the Vienna sickness insurance bureau, believes that the effect of lead upon printers is to be seen in an undue degree of intestinal and kidney disease. These statements are all founded, not upon mortality records, but upon sickness records of which we have unfortunately none in the United States.

De Vooys, of Holland, regards lead as an important factor in lowering the resistance to tuberculosis. He says also that diseases which are caused by gradual hardening of the blood vessels are commoner among printers than among workingmen in general and this is another indication of the slow action of lead. In stereotyping and linotyping especially, the exposure to lead is far from slight. The fact that few cases of plumbism among printers are known in Holland is no proof of the rarity of the disease, for no thorough medical examination has ever been made of the men in this industry.

Carozzi believes that in many cases when dyspepsia is diagnosed in a printer it is really an obscure or early form of lead poisoning. He describes such a case as follows: Ill-defined symptoms of indigestion, loss of appetite, sense of fullness after meals, regurgitation of food or eructations of gas, foul mouth, vague epigastric pain, increasing constipation, and sometimes enlargement of the liver, the edge palpable and tender. He holds the theory that the absorption of metallic lead gives rise to clinical symptoms different from those caused by the soluble salts of lead, the arthritic diseases being especially frequent in this form of poisoning. There were 28 cases of arthritis and arthralgia among his printers and 26 others who gave a history of such troubles in the past. There were also 7 who suffered from gout. On the other hand Carozzi found little chronic disease of the kidneys among printers. Lead palsy is also rare. He found but 1 case, though there were 5 who had had it in former years.

Carozzi quotes a Belgian report,[1] inaccessible to us, of Buyse, inspector of the region of Ghent. In 1905 Buyse visited 153 printing establishments. The number of workmen employed is not given, but the statement is made that he found 53 with symptoms of chronic plumbism; 30 had the lead line only; 3 had colic only; 3 had the line and constipation; 6 the line and colic; 3 colic and constipation without the line; 7 colic, constipation, and the line; and 1 had all of these, with paralysis of the upper extremities and contractures.

The figures given in the British reports are unfortunately of little value, because it is impossible to discover what is the rate of poisoning

[1] Publication of International Association for Labor Legislation. Italian section, new series, No. 4, Pt. II, p. 52.

among printers. The factory inspector's report [1] states that during 10 years—1900 to 1909, inclusive—there were 200 cases of lead poisoning among printers, with 17 deaths, but in the absence of any information as to the number of men engaged in printing in the United Kingdom, it is impossible to say whether these figures mean a moderate rate of poisoning or a low rate. Legge and Goadby do not believe the danger from lead in this industry is great; they attribute the tuberculosis of printers to the vitiated air, sensitiveness to cold, and fumes of gas from the linotypes. Oliver says that lead poisoning is not extremely prevalent among British printers, but that when tuberculosis develops in a "leaded" printer it usually runs a rapid course, the combined effect of lead and tuberculous infection being always greater than of either alone.

The best analysis of the actual part played by lead in the sickness of printers is in the study of Hahn already referred to. His statistics show the close connection between lead poisoning and tuberculosis in this industry, for the two rise and fall together, both being highest among those men whose work brings them most in contact with lead—the compositors, stereotypers, and type founders—and both diminishing as conditions in the printing trade improve. Between the years 1900 and 1907 tuberculosis decreased 40 per cent in Berlin and 57 per cent in Vienna, while lead poisoning decreased 46 per cent in Berlin and 48 per cent in Vienna.[2] As shown in the following table, the decrease in tuberculosis was greater in the typographical trades than among Germans in general, probably because of the new protection against lead poisoning.

TABLE 24.—PER CENT OF DEATHS DUE TO TUBERCULOSIS OF THE LUNGS IN BERLIN: ALL INDUSTRIES COMPARED WITH COMPOSITORS AND PRESSMEN.

[Source: Die Gesundheitsverhältnisse im polygraphischen Gewerbe Deutschlands, p. 33.]

Years.	All industries.	Compositors and pressmen.
1891 to 1893[1]	32.8	45.5
1900 to 1907[2]	30.3	35.4

[1] Data are for general population.
[2] Data are for local sick fund only.

Loriga [3] experimented with guinea pigs to determine whether lead poisoning favored the development of tuberculosis, and although his results were inconclusive when he used the relatively insoluble lead sulphate, they were quite clear when he used the soluble lead nitrate. Eight guinea pigs were fed this lead nitrate and then inoculated

[1] Annual Report of Chief Inspector of Factories and Workshops for 1909. London, 1910, p. 193.
[2] Die Gesundheitsverhältnisse im polygraphischen Gewerbe Deutschlands, p. 22.
[3] Il Ramazzini, in Giornale Italiano di Medicina Sociale, 1912, vol. 6, p. 87.

with tubercle bacilli. One died with acute lead poisoning and the others succumbed to tuberculosis after an average of 79 days; while eight other guinea pigs inoculated at the same time with tubercle bacilli but not fed lead, lived an average of 92 days.

Hahn examined 52 working printers and found that 5 had a history of lead poisoning and 1 showed the lead line. Their symptoms at the time were chiefly nervous irritability, headache, constipation, and rheumatism. The lead poisoning in this small group was almost 10 per cent, but the general statistics given by Hahn show a much lower rate. The following table gives the per cent of sickness due to lead poisoning among workmen in general and among printers:

TABLE 25.—PER CENT OF SICKNESS DUE TO LEAD POISONING AMONG PRINTERS AND AMONG MEMBERS OF GENERAL LOCAL SICK FUNDS OF SPECIFIED CITIES, 1907.

[Source: Die Gesundheitsverhältnisse im polygraphischen Gewerbe Deutschlands, pp. 16, 17.]

City and class of workers.	Per cent of sickness due to lead poisoning.		
	Males.	Females.	Both sexes.
Dresden.			
Members of general sick fund	0.80	0.02	0.50
Printers	5.15	.....	2.93
Munich.			
Members of general sick fund	.42	.06	.29
Printers	2.42	.13	1.32
Berlin.			
Members of general sick fund	.15	.....	.07
Printers	.96	.03	.68
Stuttgart.			
Members of general sick fund	.34	.03	.25
Printers	2.51	.25	1.14

SYMPTOMS OF LEAD POISONING.

The diagnosis of lead poisoning is especially difficult in this industry, because only in rare instances are the symptoms typical. The lead line is usually absent, especially if the teeth are well cared for. There may be no symptom of lead poisoning except anemia or granular changes in the red-blood corpuscles—the so-called stippling—and the principal help in diagnosis is, according to Oliver, the patient's occupation. Oliver does not find the changes in the red-blood corpuscles often enough in lead poisoning to be of much help in diagnosis; he depends more upon the general symptoms and upon the record of occupation. This means that disturbances of health occurring in a printer, as in any other lead worker, must be regarded somewhat differently from similar symptoms in a man who does not

come in contact with lead. It would be a fair comparison to say that just as a fever occurring in a man who has been living in a malarial region would have a somewhat different significance to the physician from a similar fever occurring in a man who had not been exposed to malaria, so the physician who examines a printer will pay more attention to certain symptoms often regarded as unimportant because he must always bear in mind the possibility of lead poisoning in such a case.

The symptoms of a typical case of chronic industrial lead poisoning are pallor; sallowness; metallic taste or foul taste, especially in the morning; disinclination for food, especially for breakfast; more or less obstinate constipation, sometimes alternating with diarrhea; and gastric or intestinal discomfort, sense of oppression, or even pain. There is often a loss of strength, shown by fatigue out of proportion to the amount of energy expended. Some men suffer more from headache, insomnia, and nervous irritability than from gastric symptoms and the irritability may be followed by extreme listlessness. In the course of this ill-defined, slowly progressing loss of health, a typical attack of acute poisoning may occur, rendering the diagnosis much easier. Such an attack is characterized by constipation lasting several days and then severe abdominal pain, headache, and perhaps pains in the joints or painful cramp of the muscles. The so-called "lead triad" consists in abdominal pain, constipation, and headache and is distinguished from an attack of appendicitis by the absence of fever and of that increase in the white-blood corpuscles which always accompanies acute appendicitis. Such attacks of acute poisoning may recur at long intervals and between them the man may return to work but almost always with symptoms of chronic poisoning, either referable to the digestive system or to the neuromuscular system.

In some cases the effect of the slow absorption of lead is shown especially in the neuromuscular system. Such cases suffer from headaches, pains in the joints, muscular cramps, nervous twitchings or tremors, insomnia, even depression and weakening of the memory. The typical form of lead palsy, loss of power in the muscles which extend the wrists and fingers, is not common among printers, though it does occur, but a weakening of wrists and fingers is fairly common. Rarely in this occupation is the brain affected, with a resulting lead psychosis. This condition is much more frequently found in industries which expose the worker to danger of rapid absorption of large quantities of lead, especially of the soluble compounds, than in the printers' trade, where absorption of lead by the worker is very slow. The effect of lead on the brain of printers is more likely to be that of degeneration which follows a hardening of the arteries, either softening of the brain or a stroke of apoplexy. This is because

a gradual absorption of lead continued over long periods results in a form of arteriosclerosis, and this means a slow starvation of such organs as the brain, the kidneys, the liver, and heart through a gradual shutting off of their blood supply. Softening of the brain may result from this loss of blood or if a sudden strain is put upon the brittle arterial wall, as when the blood pressure is suddenly raised, the wall may give way and an apoplectic stroke be the result. Cardiovascular disease and apoplexy are said by most authorities to be more common among printers than among occupied males in general.

Von Jaksch says lead always selects the weakest organ for its attack. In a man with damaged kidneys lead manifests itself by setting up nephritis. In one with a predisposition to nervous disease it may give rise to epilepsy.

The changes in the red-blood cells, known as stippling or basophilic granulation, are thought by Silberstein to be very characteristic of the lead poisoning among printers, while Hahn and Oliver dissent absolutely from this opinion. Carozzi takes a middle ground. He finds basophilic granular cells in the blood of printers with chronic plumbism but not as frequently as in men who have been exposed to the soluble salts of lead, for this change in the blood is always in direct relation to the rapidity of the diffusion of the poison, and in typesetting the absorption of poison is of the slowest. Carozzi finds polychromatophilia (a method of staining which indicates newly formed cells) more common in printers than granular cells. His record of blood examinations is as follows:

Among 135 printers examined he found 23, or 17.04 per cent, with basophilic granular cells; 35, or 25.92 per cent, showed polychromatophilia; and in 77, or 57.04 per cent. there were no abnormal cells.[1]

Carozzi also quotes Cosolo's examination of 111 printers, in which quite different results were obtained, as shown in the table following:

TABLE 26.—CONDITIONS FOUND IN BLOOD EXAMINATIONS OF PRINTERS AND OF MEN IN OTHER TRADES IN TRIESTE.

[Source: Publication of International Association for Labor Legislation, Italian section, new series, No. 6, Pt. IV, p. 39.]

Class.	Number examined.	Number having—		
		Granular cells.	Polychromatophilia.	Normal blood.
Printers with known plumbism	35	13	2	20
Printers with suspected plumbism	27	10	2	15
Printers without plumbism	49	19	5	25
Men in other trades	27	11	1	15

[1] Publication of International Association for Labor Legislation, Italian section, new series, No. 6, Pt. IV, p. 40.

Here the proportion of men with granular cells is really larger among the men in other trades than even among the printers known to have lead poisoning. It is evident from these records that the diagnosis of lead poisoning can not be absolutely decided by the blood examination, although it may be greatly assisted.

All this shows the difficulty of making a positive statement as to the amount of lead poisoning in the printer's trade. Probably no two medical men would interpret in the same way the symptoms or signs of disease presented by any given group of printers, for one of them would look with suspicion upon any digestive or nervous or arthritic disorder as possibly plumbic in origin, while the other would attribute it to errors in hygiene or to a fatiguing indoor occupation or to alcoholism. Therefore in summarizing the results of a physical examination of 200 printers made for the Bureau of Labor Statistics by physicians in Boston and Chicago, we have endeavored to treat the question of lead poisoning with caution and not to exaggerate its importance as a cause of disease among these men. (See page 91.)

OTHER OCCUPATIONAL DISEASES.

Printers are said to suffer from other occupational diseases besides tuberculosis—from digestive disturbances, from urinary, nervous, and skin diseases. No two students of the industry ever come to exactly the same conclusion as to the relative frequency of these disturbances, or as to the question whether they are all to be regarded as occupational in character. Even the morbidity statistics of the different authors are not really comparable, because the classification of diseases differs so much between different countries or even between two authors in the same country.

Silberstein[1] believes that the occupational diseases of printers are tuberculosis, lead poisoning, varicose veins, leg ulcers, flat foot, and neurasthenia. Printers also suffer more from skin diseases than do workmen in general. For instance, in the years 1904 and 1905 there were 20 cases of skin disease per 1,000 Berlin printers, while for each 1,000 members of the sickness insurance fund of Berlin there were only 9.3 cases in 1904 and 4.4 cases in 1905. This was largely an occupational eczema of the hands and arms caused by printer's ink, turpentine, lye, and other chemicals. Under the head of neurasthenia, including also the neuralgias, he gives the following figures for Berlin:

[1] Silberstein, in Weyl's Handbuch der Arbeiterkrankheiten, Jena, 1908, p. 251.

TABLE 27.—PER CENT OF MEMBERS OF PRINTERS' LOCAL SICK FUND AND OF MEMBERS OF THE GENERAL SICK FUND OF BERLIN AFFECTED WITH NEURASTHENIA, 1904 AND 1905.

[Source: Weyl's Handbuch der Arbeiterkrankheiten, Jena, 1908, p. 259.]

Year.	Per cent affected with neurasthenia.			
	Male members.		Female members.	
	Printers' fund.	General fund.	Printers' fund.	General fund.
1904	3.73	1.56	2.43	2.76
1905	4.09	1.25	2.66	2.24

The contrast here between male printers and all occupied males is striking, and it is also shown that there is a nervous strain among men printers to which women in the industry are not subject, for their sickness rate from neurasthenia averages about the same as that of women in other industries.

Silberstein also finds bronchial and throat catarrh, as well as gastric catarrh, rheumatism, and gout, frequent among printers, but he can not show that they are more frequent in this trade than in others. He considers it a mistake to look on the work as not strenuous, for the speed is great, and the work itself is nerve-exhausting. Especially is there a high degree of exhausting speed and worry and anxiety in newspaper work. A nine-hour day, even broken by three rest periods, is too long for such work. The characteristic nervous disturbances in printers consist of exhaustion, sense of depression, sleeplessness, palpitation of the heart, pains that have no anatomical cause, and loss of appetite. Weariness prevents the man from taking out-door exercise after his work is over.

Hahn says that many cases of obscure lead poisoning are probably diagnosed as constipation, colic, anemia, nephritis, or gastric or intestinal catarrh. He too finds a very decided excess of nervous diseases among male printers, but not among the females, as can be seen from the following table:

TABLE 28.—PER CENT OF SICKNESS DUE TO NERVOUS DISEASES AMONG PRINTERS AND AMONG MEMBERS OF GENERAL LOCAL SICK FUNDS OF SPECIFIED CITIES.

[Source: Die Gesundheitsverhältnisse im polygraphischen Gewerbe Deutschlands, p. 24.]

City and class of workers.	Per cent of sickness due to nervous diseases.		
	Males.	Females.	Both sexes.
Munich (1907).			
Members of general sick fund	4.1	5.2	4.5
Printers	7.6	4.4	6.0
Dresden (1907).			
Members of general sick fund	5.7	6.9	6.2
Printers	10.8	5.8	8.6

TABLE 28.—PER CENT OF SICKNESS DUE TO NERVOUS DISEASES AMONG PRINTERS AND AMONG MEMBERS OF GENERAL LOCAL SICK FUNDS OF SPECIFIED CITIES—Con.

City and class of workers.	Per cent of sickness due to nervous diseases.		
	Males.	Females.	Both sexes.
Stuttgart (1906).			
Members of general sick fund	3.6	4.8	3.9
Printers	5.5	4.7	5.0
Berlin (1907).			
Members of general sick fund	7.2	7.9	7.6
Printers	11.4	8.0	10.4

However, Hahn does not believe that this excess of nervous diseases, though distinctly occupational, is caused by the lead, because it is the compositors who suffer most. If the lead were responsible, the greatest amount of nervous diseases would be found among the type founders, not the typesetters. The prevalence of nervous diseases seems to depend upon the nervous strain in the work, and while lead poisoning is diminishing, this class of diseases is increasing. Shortening the working-day, as has been done in recent years, has made the speed greater and the nervous strain more intense. Nor does Hahn find any connection between digestive disturbances in printers and their exposure to lead, for there is less trouble of this kind among type founders than among the women in the trade who never touch lead. He concludes that the real occupational diseases of printers are lead poisoning, tuberculosis, and nervous diseases, the last depending upon the character of the work, the other two being interdependent, for where the rate for one is high the rate for the other is also high.

There are available from four German cities statistics of diseases among printers, classified under general heads, as respiratory, digestive, nervous, arthritic, and saturnine, and these are compared with like figures for the whole insured population. It is easy to see from the table following that the printers have a higher rate for all of these groups except the arthritic—gout and rheumatism. Diseases of the kidneys are, singularly enough, not included in the list. Hahn finds them more common among printers than among occupied males in general.

TABLE 29.—PER CENT OF MEMBERS OF GENERAL SICK FUNDS AND OF MEMBERS OF PRINTERS' FUNDS WHO WERE SICK DURING 1907, BY CITIES, AND BY NATURE OF SICKNESS.

[Source: Die Gesundheitsverhältnisse im polygraphischen Gewerbe Deutschlands, pp. 52, 53.]

City.	Per cent ill during year.											
	All diseases.		Respiratory diseases.		Diseases of digestive organs.		Diseases of nervous system.		Gout and rheumatism.		Lead poisoning.	
	General funds.	Printers' funds.	General funds.	Printers' funds.	General funds.	Printers' funds.	General funds.	Printers' funds.	General funds.	Printers' funds.	General funds.	Printers' funds.
Dresden	36.6	33.4	5.2	5.4	6.7	6.8	6.2	8.6	7.9	5.5	0.5	2.9
Munich	47.1	44.3	6.6	10.1	7.1	7.8	4.5	6.0	7.8	5.1	.3	1.3
Berlin	48.9	45.5	17.5	17.5	7.6	9.2	7.6	10.4	9.0	9.4	.1	.7
Stuttgart	52.1	(1)	6.8	10.1	13.1	17.2	3.9	5.0	14.3	11.9	.3	1.1

[1] Not reported.

In all these statistics that have been given there are sources of error in the fact that different groups of workmen are included under the same heading. Bookbinders do not do the same sort of work as compositors; pressmen are not exposed to the same dangers as stereotypers, but all four classes are often included under the same head, as, for instance, in the German reports. The Italian figures usually include compositors and pressmen, and the Dutch and English seem to cover the whole industry.

RESULTS OF MEDICAL EXAMINATION OF 200 PRINTERS.

Medical examinations were made of 100 printers in Boston and 100 printers in Chicago for use in this report. The method used by the two physicians was practically the same, but they worked independently. In Boston the examining physician was Dr. Walter W. Palmer, resident physician of the Massachusetts General Hospital, with which is connected the oldest clinic for occupational diseases in the United States. In Chicago it was Dr. John D. Ellis, who was at the time in charge of the occupational disease clinic of Rush Medical College. The results obtained by these two men were surprisingly similar; 45 of the 100 Boston men were found to be quite free from disease and 48 of the Chicago men; the remaining 107 suffered from various forms of ill health which will be detailed farther on. Following is a brief résumé of the most essential facts concerning these 200 men:

Age group.

	Number.
Under 20 years	5
20 to 29 years	54
30 to 39 years	61

	Number.
40 to 49 years	40
50 to 59 years	32
60 to 69 years	7
Over 70 years	1

Marital condition.

Married	120
Widowers	13
Single	67

Branch of trade.

Compositors, including stonemen	113
Linotype operators	43
Compositors, both hand and machine	14
Monotype casters	7
Electrotypers and stereotypers	23

Years at work.

1 to 9 years	50
10 to 19 years	51
20 to 29 years	47
30 to 39 years	36
40 to 49 years	14
50 to 59 years	1
Not reported	1

The nationalities are given separately for the two cities, as there was a great difference between the two in this respect.

Birthplace.

Boston:	Number.	Chicago:	Number.
United States	70	United States	75
England	10	Germany	5
Canada	11	Bohemia	4
Ireland	3	Poland	4
Russia	2	England	2
Newfoundland	1	Russia	2
Barbadoes	1	Denmark	2
Holland	1	Ireland	2
Armenia	1	Canada	1
		Belgium	1
		Sweden	1
		Switzerland	1

Hours of Work.—In Boston the men were all members of the union and the hours of work were therefore definitely known. Newspaper men work seven hours a day, with one-half hour for lunch. In job printing there is an eight-hour day and the men take one hour for lunch. The lunch hour is, of course, not included in the eight hours. In Chicago the union men work 48 hours a week and the time

at noon varies from one-half to one hour, depending on whether the men wish to have Saturday afternoon free, in which case they voluntarily shorten the noon hour. The union does not regulate this. Some of the men came from a job printing office which is an open shop, employing union men for the union maximum of 48 hours a week and nonunion men 52 hours. Also, a few were employed in a nonunion shop which has a 54-hour week. Even in the union shops occasional overtime work is allowed, for which the union has a special scale of prices.

Conditions of Work.—Dr. Palmer reported that practically all the linotype and monotype operators in the Boston group complained of the contamination of the air with fumes from gas burners and lead pots. Many of the hand compositors work in the same rooms with the machines. It was, however, impossible to get accurate information as to the condition of the air, for the men's statements naturally depend very much on personal prejudices. The hand compositors come in contact with benzine and gasoline in cleaning the type, but none of them complained of skin troubles caused by these substances. Every one of them emphatically insisted that he washed his hands before eating his regular meals, but several admitted eating fruit and handling chewing tobacco while at work without first cleansing the hands. In Chicago, Dr. Ellis stated that 69 of the men examined made no complaint as to hygienic working conditions, such as the presence of dust or fumes or poor light or ventilation. Among the 31 who did make complaint there were 23 who mentioned annoying fumes from melting pots or stereotyping rooms, and dust from the type cases and linotype machines. Several mentioned graphite powder used to sprinkle the forms of type during the process of electrotyping, claiming that this dust causes a chronic bronchitis and stains the sputum gray or black. Eight men said that they had had to work in company with men who were suffering from tuberculosis, and who expectorated on the floors. All the men said that they washed their hands carefully before leaving the plant and before meals.

As to alcoholism it is noteworthy that one-third of the Chicago printers who were examined freely admitted that they used alcohol to excess and occasionally became intoxicated. Dr. Ellis considered it reasonable to suppose that a large proportion of the nervous symptoms complained of by this type of men was due to alcoholism. Especially was this true of the men who complained of tremor of the hands or muscular cramps. There were 29 nonusers of alcohol among the Chicago printers, 25 occasional users, 16 moderate users, and 30 excessive users. This was on the men's own statement. In Boston, 35 men told Dr. Palmer that they did not use alcohol at

all, 21 used it occasionally, 40 moderately, and only 4 stated that they were excessive drinkers.

Of the whole number 93 men, or 46.5 per cent, may be classed as normal, for either they complained of no symptoms, and no abnormal physical condition of any importance was disclosed by examination, or the symptoms they complained of seemed to have no real basis. The remaining 107 had some disturbance of health. They were all, with one exception, working at the time the examination was made.

In discussing the typical cases of lead poisoning, we must remember how difficult it is to establish the diagnosis of chronic lead poisoning in printers. There were only two of these 200 men who showed the lead line on the gums. Only one had the characteristic stippling—basophilic granulation—of the red-blood corpuscles, yet there were 21 who had been treated by physicians for lead poisoning and in 18 of them this diagnosis seemed to have been correct, since the men still showed evidences of chronic plumbism. In addition to these 18 cases which the two physicians diagnosed to be lead poisoning, there were four whose history and symptoms were highly suggestive of the same diagnosis. If, however, we accept only the 18, we have 9 per cent of lead poisoning among the 200 printers.

The next group considered is one containing 10 men, all habitual drinkers and all given to fairly frequent periods of alcoholic excess. The symptoms of which they complain would in temperate men be strongly suggestive of lead poisoning: Gastric distress, morning vomiting, foul taste and foul breath, constipation, with occasional diarrhea, pain in the abdomen, arthritic pains or muscular cramps, tremor of the hands, weakness of grip, premature ageing, but all of these may be caused by the excessive use of alcohol, so that this group must be looked upon as very dubious. According to an Italian authority—Pieraccini—alcohol and lead form a vicious circle, for lead renders the man more susceptible to the effects of alcohol and alcohol makes him more susceptible to the effects of lead.

As for the remaining 79, who had no undoubted history of lead poisoning and showed no positive evidence of it at the time of examination, it is difficult to interpret with any degree of certainty the significance of the symptoms complained of by them, and probably no interpretation could be made which would be convincing to all physicians. It is agreed by all authorities, however, that the fact that printers are exposed in some degree to lead poisoning makes it necessary to lay greater stress upon certain symptoms in printers, and especially certain groups of symptoms, than would be the case with men engaged in a trade where there was no exposure to lead. Both Dr. Palmer and Dr. Ellis were unwilling to make any positive statement as to how much influence the men's contact with lead could be thought to have had in the production of such symptoms of ill

health as abdominal pain, constipation, headache, and articular pains, but the mere fact that these symptoms were present far more frequently than any others is in itself an indication that chronic lead intoxication might have been the basis. It is also possible, however, that all such symptoms might be attributable to irregular living and lack of hygiene, especially oral hygiene. In this connection Dr. Palmer points out the fact that 60 per cent of the Boston printers suffered from pyorrhea alveolaris, and Dr. Ellis found decayed or loosened teeth in 38 per cent of the Chicago men and pyorrhea in 23 per cent.

In examining a group of men for symptoms of lead poisoning, those which are specially significant are the following: Gastric pain and discomfort, constipation, headache, loss of appetite, foul taste in the mouth, weakness of muscles—the muscles of the hand in printers—loss of weight, loss of strength, nervous disturbances, premature hardening of the arteries, premature senility, pains in joints and muscles. The usual way in which such examinations are reported is by giving a list of the symptoms found and the number of instances in which they were found, regardless of the fact that the same man may have had several of them and thus appear several times in the list. The following table is made out in this way from the examination records of these 200 printers.

Symptoms.

	Number of cases.
Gastric distress (pain in intestines, colic, distensions)	49
Constipation	48
Diarrhea	7
Loss of appetite	13
Foul taste	17
Nausea	12
Vomiting	5
Loss of strength	8
Loss of weight	5
Headache	43
Dizziness	19
Syncope	5
Nervousness	26
Insomnia	14
Paræsthesia and anæsthesia	5
Psychosis	1
Tabes	1
Epilepsy	1
Wrist palsy	1
Diplopia	4
Arthritic pains	22
Gout	6
Muscular cramps	23

Of the symptoms discovered by physical examination the following are the most important:

25 men looked older than their age.
25 had radial arteriosclerosis but only 4 of them were under 50 years of age.
57 had a blood pressure of over 140 m. m. and of these 30 were under 50 years, as follows: 20 to 29 years, 7; 30 to 39 years, 10; 40 to 49 years, 13.
7 men had valvular heart disease (mitral insufficiency, compensated).
4 had enlargement and increased consistency of the liver.
10 had tremors of the hands.
17 had hemorrhoids.
1 had varicose veins of the legs.
24 had a slight degree of anemia, hæmoglobin between 70 and 75 per cent.
1 had granular blood cells.

Tested with a dynamometer, the general average for the right hand among the Boston men was 112, while the general average of nonprinters who were tested by the same machine was 129. In Chicago, where another dynamometer was used, the average for printers was 97, for nonprinters 120. Three cases showed loss of power of extension of wrist and fingers. One of them gave a clear history of typical wrist drop following an attack of lead colic. A fourth, who also gave a history of lead poisoning, had complete loss of extension at the time of examination.

The lead line was seen in two cases only. Polychromatophilia was found in two cases, granular cells in one; the last gave a history of recent symptoms of lead poisoning. It was not possible to examine the urine for the presence of lead, but a routine examination by the ordinary tests was made in 101 of the 200 cases. Albumen was found five times, but casts only once.

The complaint of pains in the joints was frequently made, but although such pains are characteristic of lead poisoning, yet in the majority of these cases they could be accounted for on other grounds, such as a previous attack of acute articular rheumatism, gonorrheal infection, or alcoholism.

Diseases of the skin, as shown below, were rather noticeably absent, and certainly no one could consider the slight lesions found to be of much significance when considered as occupational diseases. The acne, eczema, and dermatitis were all mild in character.

Skin diseases.

	Cases.
Mild acne, back and neck	7
Mild acne, face	2
Slight eczema	3
Dermatitis, hands	1
Dermatitis, hands and ankles	1
Tinea versicolor	1
Keratosis senilis	1
Severe seborrhea sicca of scalp	1
Carbuncles, neck	3
Festering cuts	5

The above method of analyzing the physical examination of these printers is the customary one and is given in order to make it possible to compare this with other similar examinations, but it is always a somewhat confusing method, for it does not give at all a clear picture of how these symptoms were grouped in one man, and it is this grouping which is the really significant feature. If we omit the 18 men in whom lead poisoning seemed undoubted and the 10 alcoholics, we have left 79 men who suffered from symptoms of sickness not obviously caused either by lead or by alcohol. We have divided them according to their predominating symptoms as follows:

	Cases.
Symptoms referable chiefly to the gastrointestinal tract	30
Symptoms referable chiefly to the neuromuscular system	18
Symptoms referable chiefly to both of above	25
Arteriosclerosis and premature senility	2
Arrested tuberculosis, gastric symptoms, alcoholism	1
Anemia and poor nutrition (boys under 20 years)	2
Probable renal stone	1

Of these 79 men there were 19 whose symptoms were slight and fairly negligible. On the other hand, there were 9, belonging to the group with neuromuscular and intestinal symptoms, whose histories and symptoms at the time of the examination showed decided derangement of health and were at least suggestive of chronic lead poisoning. It is impossible to say whether or not work at the printers' trade had any influence on the ill health of these 9 men or of the 79 in this group. It may be that 200 men taken from any indoor occupation which involves great nervous strain and continual standing without much muscular work, and in which nightwork is fairly common and meals are taken more or less irregularly and hurriedly, might show as large a number of digestive and nervous derangements as were found among the 200 printers. On the other hand, we know that long-continued absorption of minute quantities of lead does cause symptoms of just this character.

The most striking thing in this examination is the absence of lesions in the lungs. As we have seen, the occupational disease of printers is always held to be pulmonary tuberculosis and the statistics of all countries show the prevalence of this disease in the industry. Both of the physicians who made the examination fully expected to find a fairly large proportion of men suffering from some form of this complaint. That only one arrested case was found among 100 Chicago men and no case at all among the Boston men is hard to understand unless the reason be found in the method used in securing the cases for examination. The men were practically all volunteers. Those in Boston were requested by the Boston Typographical Union to present themselves for examination. In Chicago, the men who were examined were in part secured through the union and in part through

visits to the plants in which they were employed. But in the latter case as well as in the former the men's consent had to be obtained and both physicians were convinced that the men who suspected that they had tuberculosis shrank from being examined. This means that although every effort was made to secure groups of men in both cities who would represent a typical cross section of the printers' trade it was practically impossible to do this, and a certain selective action was exerted by the men themselves which resulted in a better showing than was probably actually true. However, even allowing for this, the entire absence of even the early stages of pulmonary tuberculosis is surprising.

Dr. Palmer speaks as follows as to this part of his examination:

None of the men showed any definite lung pathology. In several instances there was a marked degree of physiological dullness and broncho-vesicular respiration at the right apex. There were no subjects with symptoms or physical evidence of tuberculosis.

Dr. Ellis writes:

In one case, who told me he had been in the Printers' Home in Colorado for tuberculosis, I found marked dullness and bronchial breathing over the upper right lobe, posteriorly, but there were no râles. There was chronic generalized bronchitis in one case. None of the other men showed any definite lung changes in the percussion note or width of the apical isthmus on percussion or breath sounds over the apices.

When the ages of the 200 men are considered, it can be seen that a larger proportion of healthy men than of diseased men belong to the earlier age groups. This would naturally be expected. Of the healthy men 40 per cent are under 30 years of age, while only 21.5 per cent of those with some form of ill health are in this age group. As we go up in the scale of years the difference becomes less marked—68 per cent of the healthy men are under 40 years, and 54 per cent of the unhealthy; in the ages under 50 years are 83.8 per cent of the healthy, and 77.5 per cent of the diseased.

It is impossible to say to what extent these differences are caused by the unhealthfulness of the industry and to what extent by advancing years. If, however, the men are grouped according to the number of years they have spent in the printing trade, it is impossible to escape the conviction that the work itself has an unfavorable effect upon the men's health, for the differences here are greater than those in the percentages based upon actual age. Almost half of the healthy men (49.4 per cent) have worked less than 15 years; less than one-third of the diseased (30 per cent) have worked so short a time as that. Only 29 per cent of the healthy have worked as long as 25 years, while 35.6 per cent of the unhealthy have been at the trade for 25 years or more.

It seems probable that the differences here are attributable to the influence of occupation, though the figures upon which the percentages are based (only 200 men) are too small to be used as a basis for any positive conclusions.

PHYSICAL CONDITION OF MEN ENTERING THE INDUSTRY.

The statement is very frequently made by foreign writers that one reason why the printing trade has an undue amount of illness, especially of tuberculosis, is that it naturally attracts boys who are undersized, narrow chested, deficient in muscular development, and therefore predisposed to tuberculous infection. Pannwitz,[1] who made a thorough study of the printing trade in Germany, lays great stress on this feature and is able to show by figures that the trade in that country is really recruited largely from among the less vigorous. Germany's system of compulsory military service for all physically fit men involves physical examination of all, and it is from the records of the examining medical officers that Pannwitz draws his conclusions. He finds a startlingly small percentage of the men in the typographical trades fit for military service. For instance, in one newspaper plant there were only 8 fit men out of 92, only 2 compositors out of 20. The average number of men accepted for service out of 55 districts during three years, 1889, 1890, and 1891, was 427.3 out of 1,000 employed in all trades, but for the printing trades it was only 238.1. Taking one of the three years, 1891, he finds that out of 1,000 printers an average of 205.4 were found fit for regular service, 183 for second-class service, 526.8 for nonactive service (Landsturm), and 84.8 absolutely unfit.

The pressmen were the lowest in the scale, the founders next, the compositors highest. In these same three years the pressmen had an average of only 173.4 fit men out of 1,000, the founders had 211.5, and the compositors 213.3. Rejections were based chiefly on the ground of weak physical constitution, poor development of skeleton and muscles, "which does not permit the expectation that his strength would suffice for service in the field or in the reserve." Weakness of vision also is a frequent cause of rejection. Pannwitz concludes that not only are there unusual numbers of weaklings in this industry but the sanitary conditions under which they work are more productive of illness than the work itself warrants. This is said by Layet[2] to be true of the industry in France also, and the Austrian governmental report makes the same statement for Austria.

No one casually observing American printers would gain the impression that this is an industry attracting weaklings chiefly.

[1] Pannwitz, in Arbeiten aus dem kaiserlichen Gesundheitsamt, Berlin, 1896, Vol. XII, p. 686.

[2] Hygiène des Professions et des Industries, Paris, 1875.

Their general appearance is that of well-developed men in average health. Yet the figures of one of the large life insurance companies for 589 industrial policyholders show that in the United States the men who enter this trade are somewhat lower in height and weight than the general average for all other occupations. These records of weights and heights are given by Frederick L. Hoffman, statistician of the Prudential Insurance Co.

TABLE 30.—AVERAGE AND RELATIVE WEIGHT AND AVERAGE HEIGHT OF MALE PRINTERS AND OF MALES IN ALL OTHER OCCUPATIONS, BY AGE GROUPS, 1886 TO 1914.

[Source: Records of the Prudential Insurance Co.]

Age at entry.	Number at each age.	Average weight at entry (pounds).		Relative weight at entry (pounds per inch).		Average height at entry (inches).	
		Printers.	All other occupations.	Printers.	All other occupations.	Printers.	All other occupations.
15 to 24 years	126	140	145	2.05	2.12	68.2	68.1
25 to 34 years	230	149	155	2.20	2.26	67.6	68.3
35 to 44 years	150	154	160	2.28	2.35	67.7	68.1
45 to 54 years	51	159	163	2.37	2.40	67.0	67.9
55 to 64 years	31	154	163	2.29	2.40	67.4	67.8
65 years and over	1	195	162	2.91	2.38	67.0	67.9
Total	589	149	157	2.21	2.30	67.7	68.1

HEALTH CAMPAIGN OF INTERNATIONAL TYPOGRAPHICAL UNION.

In 1892 the International Typographical Union opened a home for invalid, aged, or infirm union printers in Colorado Springs, and it became clear very soon after that a large number of the printers who were incapacitated from illness and applying for entrance to the home were suffering from tuberculosis. This knowledge spread gradually among the members of the union, was discussed at the annual meetings, and interest in the sanitation of working places and in the prevention of disease, especially of tuberculosis, grew steadily. Finally, in 1907 a permanent committee on health and sanitation was formed primarily to deal with the danger of tuberculosis—"to establish healthful conditions in printing shops and to arrange for the best treatment of members of this union suffering from tuberculosis." Each local has now a sanitation committee and all chairmen of chapels—the union printers in each shop constitute a chapel—are instructed to report insanitary conditions to this committee.

Naturally, the development of this movement has followed different lines in the seven cities visited. Some committees are much more aggressive and full of initiative than others. Those of Baltimore and Washington have struck out on original lines and have made personal inspections of the shops and newspaper plants in those

cities and brought specific suggestions before the employers. They have also secured the best available expert advice on these suggestions before pushing them. Chicago, also, has a vigorous sanitary policy and employs one printer to devote his time to this work. On the other hand, Philadelphia depends on complaints from the chapels, though the men say that this does not work well and that it is far easier for an outsider to come in and criticize than it is for an employee to run the risk of making himself disliked by his employer and by his fellow workmen. St. Louis also depends on following up complaints made by the chapel chairmen. There is not, however, so much room for complaint in St. Louis as in the other cities, since one great source of trouble, the piping of linotype pots, is provided for by a State law.

The New York union, in addition to the usual sanitary activities, makes provision for sick members by maintaining beds in four hospitals. The union cooperates closely with the division of occupational diseases of the health department, and the two have recently formulated a series of recommendations for the conduct of printing establishments and for individual hygiene which is excellent. In Boston the local union cooperates with the occupational disease clinic of the Massachusetts General Hospital and distributes the leaflet on "Precautions for Printers" which was prepared by the latter.

Very good publicity work is carried on by the local sanitation committees and by the central body in Indianapolis. A little pamphlet recently issued by the latter discusses in clear language the nature of tuberculosis and all the factors in its production which are to be found in the printing trade. The Baltimore local has carried on a very intelligent educational work of this kind in its monthly bulletin.

The effects of this activity on the part of the union are very evident. Such evils as spitting on the floor and sweeping floors during working hours are more easily controlled by the men themselves than by factory inspectors. The importance of good ventilation is increasingly insisted on by the men, and this also is a matter largely within their own control. It is certainly only fair to ascribe a great deal of the recent improvement in conditions prevailing in this industry to the efforts made by the union. That much remains to be done is also true. Some of the dirtiest, worst ventilated, worst lighted shops visited were not only union shops, but label shops. Union men put up with roller towels, even in cities where they are forbidden by law, with noisome toilets, and with utterly inadequate washing provisions. There must also be a much livelier sense on the part of the trade itself that lead dust, even in minute quantities, is dangerous, before the union can say that it is safeguarding the health of its members.

The Union Printers' Home in Colorado Springs is a very remarkable instance of self-help on the part of an industry. The movement to provide for the aged and infirm was given impetus in 1886 by a gift of $10,000 from A. J. Drexel and George W. Childs. The international union and the locals added enough to this to erect, on land donated for the purpose, a building costing $62,700. In 1898 a hospital building was added and it became necessary to open a tent colony for the tuberculous. In 1907 there were 20 tents and a central building for these patients, the latter built in the form of a solarium. The home has a library of almost 10,000 volumes and 228 periodicals. Between July, 1892, and May, 1911, 1,198 printers were admitted to the home, which is open to any one who has been a member of the International Typographical Union for ten continuous years. Members who are suffering from tuberculosis may be admitted to the sanatorium at any time. The average number of residents during 1911 was 127, and the per capita cost of their maintenance was $45.10 a month, in addition to which each man receives at least 50 cents a week for his personal expenses. This little pension is usually paid by his local—the New York local gives each of its members in the home a dollar a week—or if the local does not provide it, the sum is paid by headquarters at Indianapolis.

The union has also indirectly improved health conditions in the industry by shortening the working-day. In 1869 the international union reported instances of a 12-hour, a 15-hour, and even an 18-hour day. Newspaper men often had to spend several hours in the afternoon distributing type and then go to work on composition at 7 in the evening and keep on till morning. With the introduction of the linotype machine the hours came to be defined and there was a general movement for a shorter day. At present the day in newspaper offices does not exceed 8 hours, but in book and job shops it may still be from 9 to 10 hours.

The union allows overtime work at time and a half pay from 5 in the afternoon till 10 in the evening, at double pay after 10 o'clock and on Sundays, and also on Saturdays if the 48-hour week has already been made up. On the advertising part of a newspaper the men sometimes work 15 or 16 hours with only a half hour off for lunch, but overtime is not usual now; it is too expensive. Newspaper offices may work 7 days in the week but each man works only 6. The day of the linotypist is fixed by international agreement at 8 hours on newspapers. Operators in job shops are not included.

There is general testimony to the fact that with this shorter day and lessening of overtime work has come a great improvement in the habits of the printer and consequently in his health. Men who drink to excess can not keep up as linotypists as a usual thing. The old-time "tourist" compositor also has largely disappeared. He was

notoriously a heavy worker and a heavy drinker, alternating periods of excessive overtime work with periods of drink and idleness. The last 10 years are said to have wrought great changes in this respect in the trade.

The International Typographical Union includes all employed in the composing room, and proof readers, monotype casters, and operators on the monotype keyboards. Stereotypers and electrotypers belong to the Allied Printing Trades, but have separate unions. They have not as high a standard of education for apprentices as has the typographical union.

APPENDIX A.—PROPOSED SCHEME FOR THE INSPECTION OF COMPOSING ROOMS IN THE DISTRICT OF COLUMBIA.

[HEALTH DEPARTMENT OF THE DISTRICT OF COLUMBIA.]

INSTRUCTIONS TO THE INSPECTOR.

The inspector will devote so much time to the filling in of this schedule as the circumstances of the case require. His work should be done with the least possible interference with the work of the establishment. It is not expected that he will in any case be able to fill in this schedule at a single visit. The inspector will ask instructions from the health officer, the assistant health officer, and the chief sanitary inspector from time to time as his work progresses, whenever he deems it desirable.

Establishment named_____
Located at_____
Owned by_____
Managed by_____

I. BUILDING.

Structure: Frame_____; brick, stone, or concrete_____; kind of floors _____; stories high _____.

Fire protection:

Automatic sprinkler system _____.
Fire hose_____; where located_____
Fire extinguishers: Kind_____; number_____
Where located_____
Fire-alarm system: Kind_____
Are stairways walled against fire? _____
Fire escapes _____

To what use is the portion of building put which is not used for this printing establishment? _____

Is it clean and in a generally satisfactory condition? _____

Remarks _____

II. COMPOSING ROOM.

What varieties of work are done in this room? _____

Where located?_____

	Material.	Structural condition.	Cleaning.		Condition as to cleanliness.
			Method.	Frequency.	
Walls					
Floors					
Ceilings					

Floor area____square feet. Height of ceiling____feet. Air space____cubic feet.

II. COMPOSING ROOM—continued.

Ventilation:

	No.	Location.	Total area.
Windows			
Total			
Doors			
Total			

Artificial ventilation: Yes_____; No_____

	Number fans.	Diameters.
Plenum system		
Exhaust system		
Other mechanical contrivances		

Nature and extent of odors_____

Does room seem adequately ventilated? _____

Remarks _____

Lighting:

Windows and doors. (See also Ventilation.)

Condition of windows as to cleanliness_____

Are window shades provided? _____

Are awnings provided? _____

Does natural light seem adequate? _____

Time of inspection.		Condition of atmosphere.			Remarks.
Day.	Hour.	Bright.	Dull.	Dark.	

[Report should cover at least three inspections, avoiding the same hour and day of same type.]

Artificial light:

Kind—

Gas: Open flame_____; mantle_____

Electricity: Arc___; carbon filament___; tungsten___; nitrogen___

Number of burners or globes_____

Location of lights _____

Total candlepower_____

What is done to obtain proper distribution of light? _____

What is done to prevent glare? _____

Does artificial light satisfactorily make up for deficiencies of natural lighting? _____

To what extent is nightwork done? _____

Remarks _____

II. COMPOSING ROOM—concluded.

Heating:

Hot air_____; hot water_____; steam_____; direct_____; indirect_____; combined_____

Are facilities for heating adequate? _____

Are facilities for carrying off surplus heat from machines, etc., adequate? _____

Are thermometers in use for regulating temperature? _____

Is automatic heat regulation in use? _____

Remarks _____

III. EQUIPMENT.

	Piped to carry off heat and gases.		Not piped.	Total.
	Number satisfactory.	Number unsatisfactory.		
Linotype machines				
Monotype machines				
Casters				
Remelting furnace				

Is remelting furnace in composing room?_____

Can linotype pots be closed?_____; were they found closed at times of inspections?_____

How are linotype pots heated? Gas?_____; electricity?_____

How are linotype plungers cleaned?_____

Was scrap lead found on floor about machines at times of inspections?_____

Keyboards: Number?_____; kind?_____

Cases: Number?_____; kind?_____

Are bottoms of cases set flush with floor?_____

On sanitary leg base?_____; if not, how high is bottom of case above floor?_____

How are cases cleaned?_____

Condition as to cleanliness at times of inspections?_____

Was space under cases clean at times of inspections?_____

How are type cleaned?_____ Potash?_____; benzine?_____

Remarks_____

IV. SANITARY PROVISIONS FOR EMPLOYEES.

Toilet accommodations:

For males—

Location_____

	Number.	Structural conditions.	Condition as to cleanliness.
Water-closets			
Urinals			

IV. SANITARY PROVISIONS FOR EMPLOYEES—continued.

Toilet accommodations—Concluded.

For males—Concluded.

Spigots for washing hands, etc.

Location_____

Number_____; hot water_____; cold water_____

Shower baths_____

Towels:

Number_____; kind_____; frequency of changing_____

Condition as to cleanliness_____

Spittoons:

Number_____; kind_____; how cared for_____

For females—

Location_____

	Number.	Structural conditions.	Condition as to cleanliness.
Water-closets			

Spigots for washing hands, etc.:

Location_____

Number_____; hot water_____; cold water_____

Shower baths_____

Towels:

Number_____; kind_____; frequency of changing_____

Condition as to cleanliness.

Are toilet accommodations adequate?_____

Are toilet accommodations in good condition?_____

Remarks_____

Is a dressing room provided?—

For males_____; for females_____

Are lockers provided?—

Number_____; kind_____

Location_____; condition as to cleanliness_____

Is a lunch room provided? _____

Location? _____

Is it screened? _____

Nature of accommodations? _____

Drinking water:

How secured?

Bubbling fountains_____; number_____

Ice coolers_____; number_____; kind_____

How cleaned_____

How frequently cleaned_____

Common drinking cups_____; number_____; kind_____

How cleaned? _____

How frequently cleaned _____

Individual drinking cups_____

Remarks_____

IV. SANITARY PROVISIONS FOR EMPLOYEES—concluded.

Is washing of hands compulsory?_____; of face?_____
Are rules posted for sanitary guidance of employees?_____
If so, how enforced?_____
If not, are recommendations posted? _____
Obtain a copy of any such regulations or recommendations, if practicable.
Are medical examinations of employees required? _____
If so, how are they provided for? _____
Is there any professional supervision over sanitary conditions of the establishment? _____
If so, what? _____
Remarks _____

V. EMPLOYEES.

	Hand composition.	Machine composition.	Other work.	Total.
Number of males				
Number of females				
Total				

State per employee—
Floor space, _____ sq. ft.; air space, _____ cu. ft.
Window area, _____ sq. ft.; lockers, _____; drinking cups, _____; towels _____
Water-closets for males, per male employee _____; urinals, per male employee_____; water-closets for females, per female employee_____
Number of tuberculous employees, known to the manager as such_____
Precautions taken against the spread of the disease_____
Remarks _____

VI. RECOMMENDATIONS.

NOTE.—Embody each recommendation in a separate paragraph and number the paragraphs serially.

———— ————, *Sanitary Inspector.*

APPENDIX B.—PRECAUTIONS FOR PRINTERS.

[MASSACHUSETTS GENERAL HOSPITAL.]

I. Remember pig lead used in linotyping is softer than lead of type. Handle it as little as possible.

II. Drop pig lead carefully into melting pot. Splashings of molten lead dry and become lead dust.

III. Do not shake crucible in order to blend molten lead better. It will blend of itself.

IV. Plungers on linotype machines should never be cleaned in the workroom. Clean them in boxes in the open air.

V. Avoid lead dust, as much as possible, when trimming and mitering, or when sawing and routing. Wear a respirator when routing.

VI. Graphite used for lubricating is not poisonous, but all dust is irritating to the lungs.

VII. Lead dust in type cases should be removed in the open air, or by means of a vacuum cleaner.

VIII. Benzine and lye are skin irritants. Wear gloves when cleaning type with them, and carefully wash the benzine and lye from the type.

IX. Never put type in the mouth, or moisten the fingers to get better hold of type.

X. Insist upon having good ventilation in the office or factory, and insist that floors should not be swept during working hours.

XI. Suggest to your employer that walls and ceilings of workroom, if not of smooth washable surface, should be limewashed once a year; that close-fitting floors which can be cleaned by moist methods are desirable; and that type cases should fit closely on the floor, or have legs high enough to brush under.

XII. Eat a good breakfast before beginning work. Food in the stomach helps to prevent lead poisoning.

XIII. Do not eat food, or use tobacco, while working, because of the danger of getting lead into the mouth.

XIV. Wash hands thoroughly with warm water and soap, and rinse the mouth and clean the finger nails before eating.

XV. Have your own towel and cake of soap.

XVI. Eat your lunch outside the workroom.

XVII. Do not wear working clothes too long without change.

XVIII. Hang street clothes apart from the dust of the workroom.

XIX. Bathe frequently and brush the teeth each night.

XX. Avoid alcohol. It increases the danger of lead poisoning.

XXI. Have a good bowel movement each day.

XXII. Exercise in the fresh air as much as possible.

XXIII. Be examined by a doctor occasionally, and do preventive work by keeping in good health.

APPENDIX C.—HYGIENIC REGULATIONS FOR PRINTING AND TYPE-CASTING ESTABLISHMENTS.

[DEPARTMENT OF LABOR OF NEW JERSEY.]

Suitable toilet accommodations shall consist of separate toilet rooms for the sexes, properly heated, ventilated either by natural or mechanical means, and provided with a vestibule so as to insure privacy to the users thereof.

One siphon action toilet shall be provided for every 20 persons or fraction thereof. One urinal for each 50 persons or fraction thereof.

Washing accommodations shall be provided on a basis of one hot and one cold water tap for each five persons.

Sanitary steel lockers shall be provided in a clean, heated, and ventilated dressing room. Lockers shall have the following minimum dimensions, it being understood that larger ones may be used if so desired: 60 inches high, 12 inches wide, and 15 inches deep.

Floors of all rooms where lead is used or handled must have smooth even surfaces so as to permit of thorough cleaning. Floors that are cleaned with a broom must be thoroughly moistened before cleaning.

All floors must be cleaned by a vacuum system where it is impossible to clean with a broom without raising dust.

Dross skimmings from lead pots must be poured into a container provided for this purpose. Plungers must be cleaned either under an exhaust hood or else in a cleaning box.

Gas-pipe joints connected with linotype machines must be examined at least once each day so as to prevent air pollution from gas leaks. Type metal must be cleaned either under an exhaust hood or else by means of a vacuum system.

All lead melting pots, including linotype and monotype pots, stereotype kettles, and remelting kettles, must be equipped with mechanical exhaust hoods. Linotype machines shall be provided with the following exhaust equipment:

Each lead pot shall have a hood with the following dimensions: 10 inches long and 10 inches wide at the largest end. Hood when in position shall hang at a distance no greater than 6 inches above the rim of the melting pot. Hood shall be so constructed as to permit it to slide on the branch pipe to which it is connected. Each hood shall have a suction pipe 4 inches in diameter. Main suction pipe to which all branch suction pipes shall be connected must at all cross-sectional points have an area at least equal to the combined areas of branches at each cross-sectional point.

The exhaust fan must operate at a speed sufficient to generate an air movement in each branch pipe of at least 1,000 linear feet per minute. Test to be made by placing an anemometer at the end of the branch pipe where it connects with the hood. Entire line must be open and unobstructed when test is made.

Stereotype kettles must be completely hooded in, proper slots and doors being provided, as per detailed blue print, to permit of dross skimming and pump action.

Each hood shall have an 8-inch exhaust pipe in which an air movement of at least 1,000 linear feet per minute shall be generated. Test to be made by placing an anemometer in the branch pipe at the point where it connects with the hood.

Remelting kettles, where lead slugs are remelted and cast into bars, must be equipped with an exhaust hood of a type to be decided by the type of melting

pot. In all cases an air movement of 1,000 linear feet per minute must be generated in the branch pipe leading from the exhaust hood. Test to be the same as in the case of a stereotype kettle.

The fumes passing through the exhaust fan must be discharged outside the workroom at a point where they can not return through openings in the building.

Exhaust systems shall be constructed of galvanized sheet steel in accordance with the following details:

Piping—Diameter.

4 to 10 inches	No. 24 gauge.
11 to 18 inches	No. 22 gauge.
19 to 26 inches	No. 20 gauge.
27 inches and larger	No. 18 gauge.
Hoods	No. 22 gauge.

Elbows.—One gauge heavier than the pipe to which they are attached.

Riveting.—All straight seams should be riveted with tinned rivets placed on 2½-inch centers. All round seams should be riveted as follows:

Piping—Diameter.

4 to 8 inches	4 rivets.
9 to 12 inches	5 rivets.
13 to 18 inches	6 rivets.
19 to 24 inches	7 rivets.
25 to 30 inches	8 rivets.

All elbows to be riveted on 2½-inch centers.

Soldering.—All seams should be heavily soldered with pure half-and-half solder. The soldering is very important, as it prevents loss of air due to leakage. (Engineers claim that usually 10 per cent of power loss is due to leakage.) Soldering also prevents corrosion of the edges of the metal which have become exposed by cutting into the stock-sheets.

Edges.—All exposed edges not attached to other metal should be wired. It is especially important to have all hoods wired. This strengthens the hoods and prevents the operators from receiving cuts from raw edges.

Laps.—All piping, etc., should have at least a 1-inch lap, made in the direction of the flow of the air current. This prevents dust clogging and friction loss.

Elbows.—All elbows should be made on a radius of not less than 1½ times the diameter of the elbows. Said radius to be measured from the throat of the elbow. All elbows should be made of hand-swagged riveted sections, and be hand-pounded as smooth as possible.

Collars.—All pipe collars should enter the main pipes at not more than a 45-degree angle, and should be riveted and soldered to the main pipes.

Blast gates.—Every branch pipe shall be fitted with a blast gate, with the slide attached to the gate with a chain.

Telescopic slip joints.—All telescopic slip joints should be made with a wired outer edge, and with felt packing between them to prevent air leakage.

Fan inlet connection.—At the point where the piping connects to the suction side of the exhaust fan, there should be a detachable sleeve, so that ready access to the interior of the fan may be had at any time without damaging the piping system.

Automatic fire dampers.—Wherever piping passes through a wall or floor, or from one building to another, an automatic fire damper should be installed. This should be so constructed with balance weights that it remains closed when the fan is not in operation, or will fall shut should fire strike the fusible link holding the balance weight.

PLATE NO. 1.—MECHANICAL EXHAUST SYSTEM FOR THE REMOVAL OF NOXIOUS FUMES FROM LINOTYPE MACHINES.

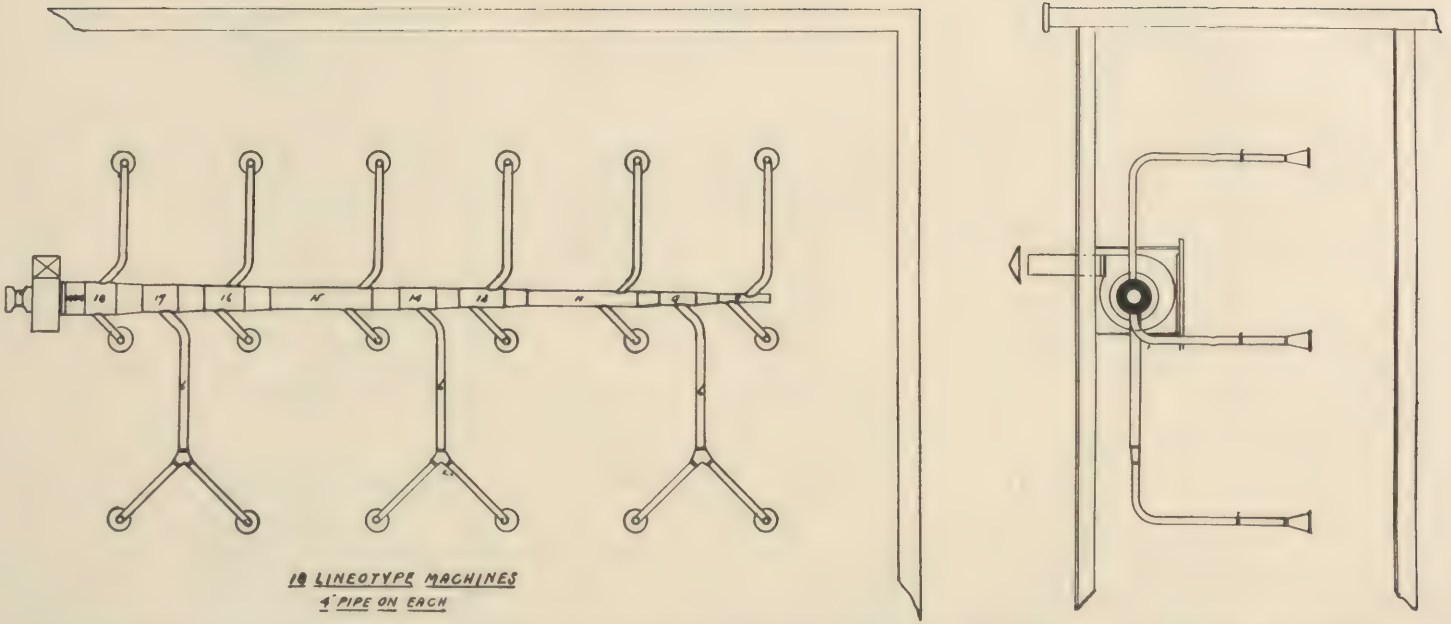


PLATE NO. 2.—MECHANICAL DRAWING SHOWING DETAILS OF CONSTRUCTION OF EXHAUST SYSTEM FOR LINOTYPE MACHINES.

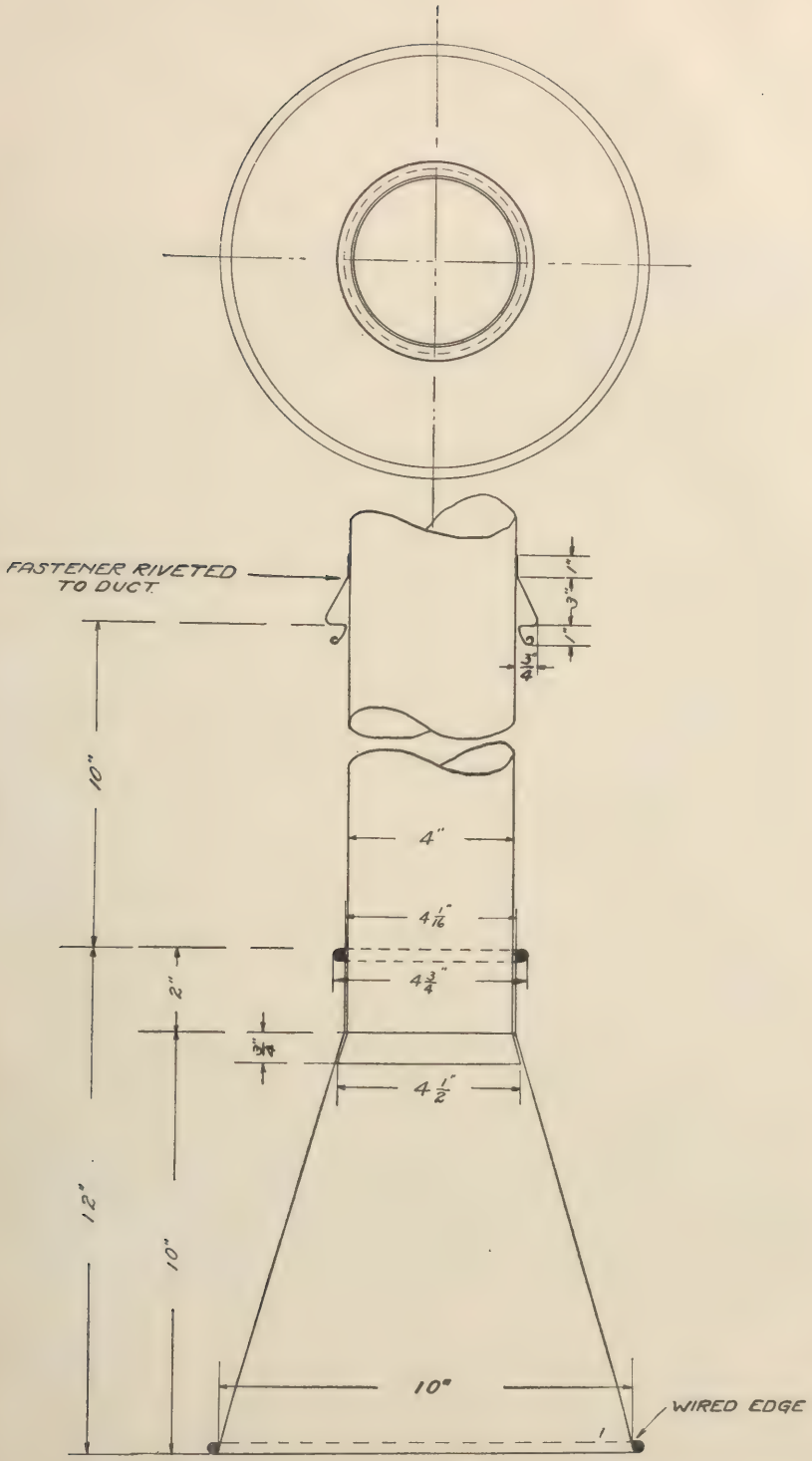
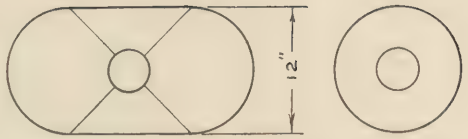


PLATE NO. 3.—MECHANICAL DRAWING SHOWING DETAILS OF CONSTRUCTION OF EXHAUST HOOD FOR LINOTYPE MACHINES.



HOOD FOR MONOTYPE

HOOD FOR LINOTYPE.

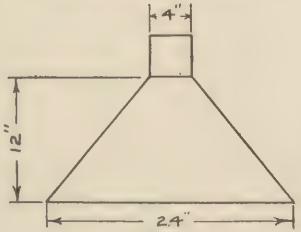


FIG. 2

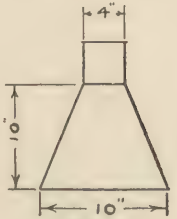


FIG. 3.

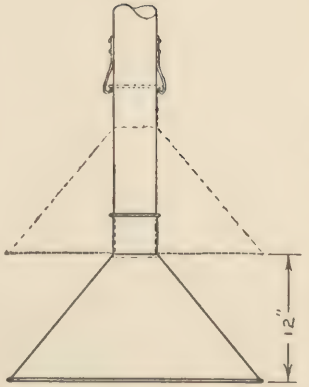


FIG. 4

SPECIFICATIONS

CROSS SECTIONAL AREA OF MAIN DUCT AT ANY POINT TO BE AT LEAST EQUAL TO COMBINED AREA OF BRANCHES FROM DEAD END OF SYSTEM UP TO THAT POINT. SEE FIG. 1.

BRANCH PIPES TO HOODS TO BE 4" IN DIAMETER

LINOTYPE HOODS TO BE AS SHOWN IN FIG. 3. 4" CONNECTION

MONOTYPE HOODS TO BE AS SHOWN IN FIG. 2. 4" CONNECTION

HOODS TO SLIDE AS SHOWN IN FIG. 4

SUCTION TO BE SUFFICIENT TO PRODUCE AN AIR MOVEMENT IN EACH BRANCH PIPE OF 1000 FEET PER MIN. TEST TO BE MADE WITH ANEMOMETER

DISTANCE FROM TOP OF POT TO LOWEST POINT OF HOOD TO BE 6" WHEN HOOD IS DOWN

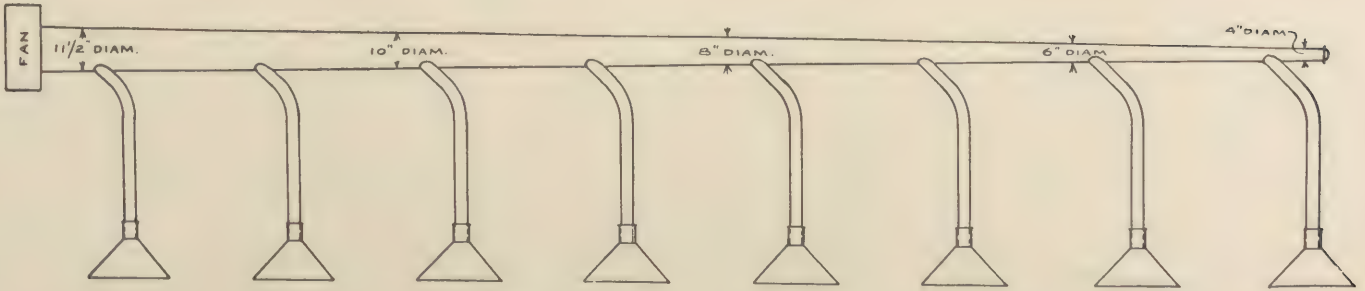


FIG. 1

PLATE NO. 4.—MECHANICAL DRAWING SHOWING HOW TO CONSTRUCT AN EXHAUST HOOD FOR LINOTYPE MACHINES.

PLATE NO. 5.—SHOWING INSTALLATION OF EXHAUST SYSTEM FOR LINOTYPE MACHINES.

PLATE NO. 6.—OPEN TYPE OF EXHAUST HOODS FOR MELTING KETTLES IN STEREOTYPE ROOM.

PLATE NO. 7.—MELTING KETTLES IN STEREOTYPE ROOM COMPLETELY INCLOSED WITH EXHAUST HOOD. ACCESS TO KETTLE GAINED BY MEANS OF A SLIDING DOOR.

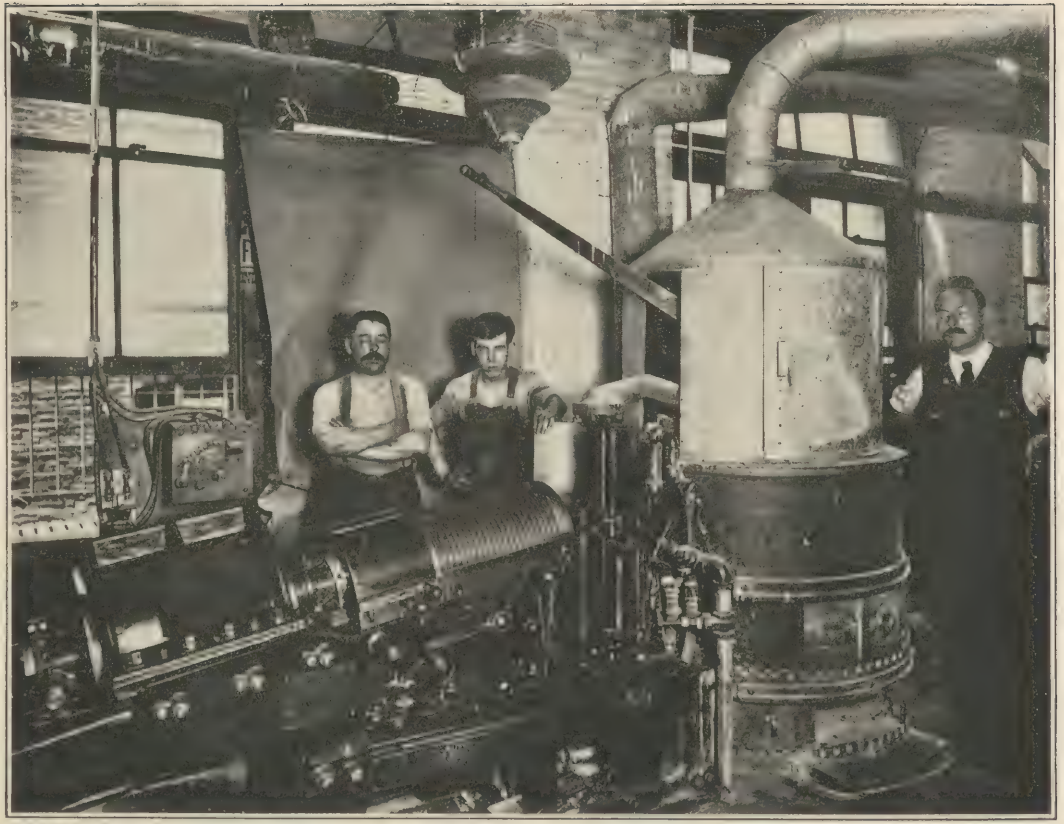


PLATE NO. 8.—EXHAUST HOOD ON MELTING KETTLE IN STEREOTYPE ROOM, SHOWING SLOT FOR PUMP ACTION.

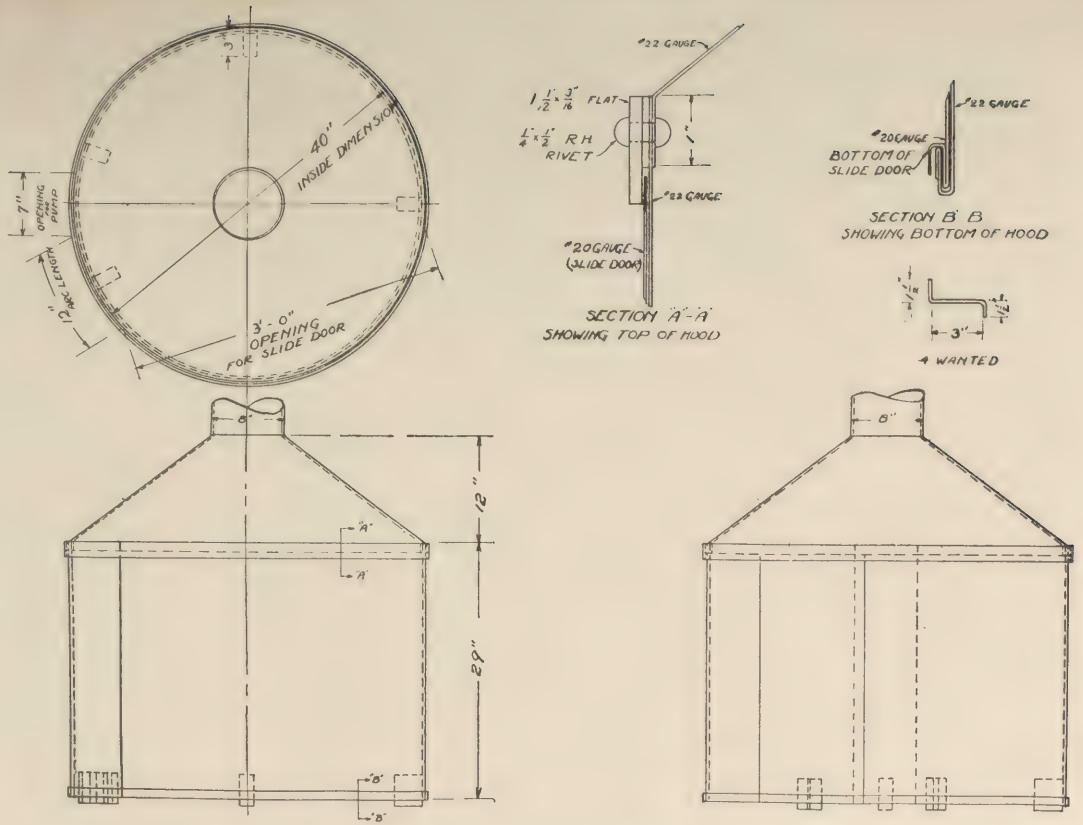


PLATE NO. 9.—MECHANICAL DRAWING SHOWING DETAILS OF CONSTRUCTION FOR HOOD FOR STEREOTYPE MACHINE.

APPENDIX D.—TIMELY HINTS NO. 7.

[PENNSYLVANIA LABOR DEPARTMENT.]

FOR PRINTERS.

LENGTHEN YOUR LIFE BY GUARDING YOUR HEALTH. LEARN THE DANGERS OF YOUR TRADE AND THEN AVOID THEM.

POISONS IN PRINTING.

Lead, the main constituent of type metal, is absorbed into the system chiefly from the stomach and in small part from the lungs and possibly from the skin. The dust of the workroom always contains lead in very finely divided form. Unless very great precautions are taken this settles on the floor, the hands, or the lips, and is in this way carried to the stomach.

Taken into the body, it produces:

Colic.
Constipation.
Paralysis.
Disease of the heart, blood vessels, and kidneys.
Insanity.
Death.

Protect yourself from it in every way:

Do not splash metal from your melting pots; it dries, becomes dust, and you inhale the lead.

Never hold type in your mouth.

Do not permit dry sweeping of your workroom or dusting of the fonts while you are present. The only safe way of cleaning during working hours is vacuum cleaning.

Do not keep your lunch exposed to the dust of the workroom.

Never touch food or place your fingers in your mouth without first washing your hands thoroughly. A nail file or other instrument for cleaning the nails, a brush, hot water, and soap are necessary if the lead is to be removed thoroughly.

Benzine is often used to clean the ink from the rolls of the printing presses. Poisoning from this substance produces:

Faintness.
Dizziness.
Headache.
Vomiting.

This material should be used only in places that are well ventilated.

Anilin oil oil forms a part of some of the mixtures used in cleaning rolls. It is more poisonous than benzine, and, in addition to the symptoms given under benzine, may, in severe cases, cause:

Convulsions.
Death.

Find out whether or not the cleaning mixture contains anilin oil. If it does, use it only in well-ventilated rooms. Do not splash any of it on your body, your clothes, or the floor. You may be poisoned by absorbing it through the skin or by breathing the fumes as the liquid evaporates.

Poisonous gases are given off by all fires. In addition, most gas fires do not burn up all the gas but allow some of it to escape into the room. See that all fires have flues in good working order leading to the outside air, in order to carry away any gases that might injure your health.

TUBERCULOSIS.

Of every 1,000 deaths among printers 292 are caused by tuberculosis. To have this disease you must take the germ into your body. You may get it from the common drinking cup, the common towel, or from your coughing neighbor who spits on the floor. If your employer does not provide individual cups and towels, provide your own. Your health is worth it. Plenty of cuspidors conveniently placed and in a clean shop ought to prevent everybody from spitting on the floor.

INACTIVITY.

Long sitting or standing in one position, especially in rooms without plenty of fresh air, causes poor circulation of the blood. Overcome this by plenty of exercise in the open air after working hours.

LIGHT.

If you can't have daylight for your work, endeavor to have all artificial lights properly placed and shaded so as to keep the glare from your eyes. You need the best light possible to do your work quickly and well. A printer with eyesight ruined is a printer out of a job.

Death from tuberculosis or lead poisoning is absolutely unnecessary. If you contract either of these diseases, see your physician at once. Both are curable if treatment is begun early and carefully carried out.

APPENDIX E.—REGULATIONS OF THE IMPERIAL CHANCELLOR OF GERMANY OF JULY 31, 1897, CONCERNING THE ERECTION AND MANAGEMENT OF PRINTING WORKS AND TYPE-FOUNDING WORKS, AMENDED BY THE REGULATIONS OF JULY 5, 1907, AND THOSE OF DECEMBER 22, 1908.

On the basis of paragraph 120(e) of the Factory Act the Bundesrath has decided upon the following regulations:

I. The following regulations are to be in force for workrooms in which persons are employed in setting up type or in stereotyping:

(1) The floor of the workroom must not be more than half a meter [1.64 feet] below the roadway. Exceptions may be permitted if, with satisfactory isolation of the site and provision for sufficient light and air, health requirements are otherwise observed.

Rooms underneath a roof can only be made use of as workrooms if the roof is lined with wood or plaster.

(2) In workrooms wherein type or stereotype plates are made the air space must be such that each employee shall have at least 15 cubic meters [529.7 cubic feet]. In rooms in which persons are employed in other processes at least 12 cubic meters [423.8 cubic feet] of air space must be provided.

In cases of temporary exceptional exigency the higher administrative authorities may on request of the undertaker permit during a maximum period of 30 days, the air space of the workrooms to be utilized in a more intensive manner, requiring, however, at least 10 cubic meters [353.1 cubic feet] to each employee.

(3) The workrooms must be at least 2.6 meters [8.53 feet] high when 15 cubic meters [529.7 cubic feet] of air space are allowed to each person; in all other instances they must be 3 meters [9.84 feet] in height.

The rooms must be provided with windows in sufficient numbers and size to obtain the maximum of light in all places where work is carried on. The windows must be so constructed as to allow of being opened for the purpose of ventilation.

Workrooms with a slanting ceiling must have an average height, as mentioned in the first part of this paragraph.

(4) The workrooms must be provided with hard and nonporous floors, so as to permit moistening for the ready removal of dust. If the floors are of wood they must be well planed and nonabsorbent.

Where the walls and ceilings are not paneled or painted with oil they must be whitewashed at least once a year. Paneled and oil-painted walls must be washed at least once a year; oil-painted walls if varnished must be revarnished at least once in every 10 years, and if not varnished must be repainted every 5 years.

The typesetters' stands and the shelves for the cases which hold the type must either be so fixed to the floor that no dust can accumulate below them, or they must be provided with such high feet that the floor beneath them can be easily cleaned.

(5) Workrooms must be thoroughly ventilated at least once a day. Care must also be taken that a sufficient change of air is obtained during the working hours.

(6) The melting pots for type and stereotype metal must be provided with proper exhausts and hoods.

The fusion of mixed type metals and the remelting of scums must be carried on in special workrooms. If these do not exist, employees not concerned in this work must be excluded while it is being done.

(7) The workrooms and all furnishings, but especially walls, shelves, and window sills, must be thoroughly cleaned at least twice a year.

The floors must be thoroughly cleaned once a day, either by washing or by mopping, so as to keep them free from dust.

In the case of wooden floors or where there is linoleum treated with an absorbing oil (a nondrying mineral oil), washing may be dispensed with, but a daily sweeping will be necessary. The treatment with oil must be renewed in the case of wooden floors at least every eight weeks and in the case of linoleum-covered floors at least every two weeks.

(8) Type cases must be cleaned before being used and as long as they are being used must be cleaned at least twice a year.

The dusting of these cases must be done in the open air by means of bellows, and must not be attempted by young persons.

(9) Spitting on the floor is forbidden. Spittoons containing water must be provided in the ratio of one for every five men.

(10) For typesetters as well as for type founders, polishers, and grinders there must be provided either in the workrooms or in suitable rooms close at hand sufficient washing conveniences, including soap and one clean towel, for each person at least once a week.

If there is no running water, there must be one washstand for at least every five workmen. The water must be of sufficient quantity, and there must be means of emptying it.

Employers must exercise strict vigilance that no food is taken into the factory, and they must see that no man leaves without first having had a wash.

(11) Wearing apparel which is not worn during working hours must be kept outside of the workrooms. The keeping of such apparel within the workrooms is permitted only in lockers or in cupboards protected from dust by tightly fitting curtains. During working hours these lockers and cupboards must be kept closed.

(12) All lighting arrangements which give rise to considerable heat must be provided with necessary exhausts.

(13) Employers must draw up regulations for the carrying out of paragraphs 8, 9, 10, and 11.

In any factory where there are 20 or more workmen employed the above rules must be incorporated with the regulations of the factory.

II. In every workroom there shall be hung a notice signed by the local authority, stating:

(a) The length, breadth, and height of the workroom.

(b) The cubic capacity of the room.

(c) The number of men allowed to work in the room.

In every workroom there must be, in addition, a notice printed in large type giving the regulations under No. I.

III. Exemptions from the regulations under No. I may be granted by the administrative authorities when there are not more than five workmen employed.

IV. The above regulations come into force immediately for all new factories.

For all factories which are in existence at the time of the announcement paragraphs 5, 7, and 9 of No. I come immediately into force and the remainder a year after the publication of the regulation.

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(Continued from second page of cover.)

*1910–1912, Report on condition of woman and child wage earners in the United States (S. Doc. 645, 61st Cong., 2d sess.):
Vol. I, Cotton textile industry.
Vol. II, Men's ready-made clothing.
Vol. III, Glass industry.
Vol. IV, Silk industry.
Vol. XI, Employment of women in the metal trades.
Vol. XII, Employment of women in laundries.
Vol. XIV, Causes of death among woman and child cotton-mill operatives.
Vol. XVII, Hookworm disease among cotton-mill operatives.
Vol. XVIII, Employment of women and children in selected industries.
Vol. XIX, Labor laws and factory conditions.

Bul. 98, January, 1912, Conciliation, arbitration, and sanitation in the cloak, suit, and skirt industry in New York City.

Bul. 100, May, 1912, List of industrial poisons and other substances injurious to health found in industrial processes.

A list of bulletins issued since July 1, 1912, in the series "Industrial Accidents and Hygiene," is as follows:

No. 1. Lead poisoning in potteries, tile works, and porcelain enameled sanitary ware factories. (Bul. 104.)

No. 2. Hygiene of the painters' trade. (Bul. 120.)

No. 3. Dangers to workers from dusts and fumes, and methods of protection. (Bul. 127.)

No. 4. Lead poisoning in the smelting and refining of lead. (Bul. 141.)

No. 5. Industrial accident statistics. (Bul. 157.)

No. 6. Lead poisoning in the manufacture of storage batteries. (Bul. 165.)

No. 7. Industrial poisons used in the rubber industry. (Bul. 179.)

No. 8. Report of British departmental committee on the danger in the use of lead in the painting of buildings. (Bul. 188.)

No. 9. Report of committee on statistics and compensation insurance cost of the International Association of Industrial Accident Boards and Commissions. (Bul. 201.) [Limited edition.]

No. 10. Anthrax as an occupational disease. (Bul. 205.)

No. 11. Causes of death by occupations. (Bul. 207.)

The following bulletins, published since July 1, 1912, but not included in the series "Industrial Accidents and Hygiene," also contain important material relating to the subject of industrial hygiene:

Bul. 101, July, 1912, Care of tuberculous wage earners in Germany.

Bul. 122, May, 1913, Employment of women in power laundries in Milwaukee.

Bul. 142, February, 1914, Administration of labor laws and factory inspection in certain European countries.

Bul. 145, April, 1914, Conciliation, arbitration, and sanitation in the dress and waist industry of New York City.

Bul. 157, March, 1915, Industrial accident statistics.

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* Supply exhausted.